21世纪全国本科院校电气信息类创新型应用人才培养规划教材

电气信息工程专业英语

余兴波
霍金明 编著
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精心挑选英文原文和文章
细心讲解专业词汇及短语
耐心翻译长复句子与难点

北京大学出版社
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内 容 简 介

本书以电气信息工程专业知识为背景，通过英文课文的阅读，学习用科技英文术语和观念理解电气信息工程的专业知识和概念，对专业英语词汇、短语等及词法、语法、句型等进行详细的讲解，对专业文献的翻译进行详细的分析。本书按照知识由浅入深，共分为 12 个单元，主要内容涉及计算机、数字电子技术、模拟电子技术、通信工程、电力电子、电子元器件等方面。

在参考了大量同类著作和国外期刊的基础上，本书精心挑选了具有代表性的英文原文文章，书中每个单元均包括正文和阅读两部分，其中正文部分附有课文中出现的专业词汇、短语、长难句的详细讲解和练习题，且两部分均有参考译文，能够帮助读者更好地掌握所学内容，还可以使学生适应毕业后到合资、外企等单位的工作环境。

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前　言

在市场竞争日趋激烈的今天，民办高校、独立学院必须要走出一条属于自己的教育之路。引进职业化教育并创新实践教育体系，是保证民办高校、独立学院走出自己应用型本科特色道路的有效措施。

为此，作为“大学应用本科实践教学与职业化教育系列教材”，编者2010年组织编写了一套《机械信息工程专业英语教程》，主编余兴波，分I、II两册，2011年3月由吉林出版集团有限责任公司出版，缓解了独立学院机械工程、信息工程专业学生专业英语教材短缺的局面。该教材自出版使用以来，收到了较好的教学效果，因为作为教材的课文均是经过精心挑选且具有代表性的英文原文，在教材内容和难度上，适合独立学院学生的英语水平，循序渐进，实践练习，容易入门，且激发学生学习兴趣。教材体现了一切为学生发展的宗旨，以学生就业为中心，本校机械、信息类学生的就业实例证明，专业外语的学习提高了学生在独资、合资、外企等企业的就业能力。

由于教学需求，并且按照学校领导关于教材建设的要求和安排，在北京大学出版社的支持和鼓励下，编者认真研究并采纳了一些学校的师生在使用教材过程中提出的宝贵意见，同时将编写教材中存在的错误进行了逐一修订。修订内容分为“正文”、“阅读课文”的专业译文、注释、Word-Study, Sentence Patterns 和 Exercises 等。全书由12篇课文组成。修订再版的教材，其书稿的质量由修订者“文责自负”。

本书的修订工作由长春光华机械工程学院副院长余兴波教授、霍金明（常务）、顾晓琳（常务）、任婷共同完成。《电气信息工程专业英语》教材修订体系分工如下：

霍金明负责编写第1、2单元和第5、6单元；

余兴波、于大海负责编写第3、4单元和第7、10单元；

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顾晓琳负责编写第1～6单元 Word-Study, Sentence Patterns, Exercises, Translation；

任婷负责编写第7～12单元 Word-Study, Sentence Patterns, Exercises, Translation。

全书的统稿、校稿工作由余兴波、霍金明、顾晓琳、任婷共同完成。

本书在编写过程中得到了学院董事长、院长等各位领导的大力支持和帮助；学院公共外语教研部主任滕玉梅教授审阅了书稿；北京大学出版社的编辑在教材的策划、修订、编写、版式设计等方面做了大量工作，在此一并表示感谢！

由于编写水平有限以及时间紧迫，有些是属专业英语课程实践教学体系改革方面所做的点滴尝试，其中难免存在不当和疏漏之处，敬请读者批评指正。

编　者

2013年5月于长春

目　　录

Unit 1

Text 1: Octal and Hexadecimal Numbers

Radix 10 is important, because we use it in everyday business, and radix 2 is important, because binary number can be processed directly by digital circuits. Numbers in other radices are not often processed directly, but may be important for documentation or other purposes. In particular, the octal and hexadecimal numbers can provide convenient shorthand representations for multibit numbers in a digital system.

The octal number system uses radix 8, while the hexadecimal number system uses radix 16. Table 1-1 shows the binary integers from 0 to 1111 and their octal, decimal, and hexadecimal equivalents. The octal system needs 8 digits, so it uses digits 0~7 of the decimal system. The hexadecimal system needs 16 digits, so it supplements decimal digits 0~9 with the letters A~F.

The octal and hexadecimal number systems are useful for representing multibit numbers, because their radices are powers of 2. Since a string of three bits can take on eight different combinations, it follows that each 3-bit string can be uniquely represented by one octal digit, according to the third and fourth columns of Table 1-1. Likewise, a 4-bit string can be represented by one hexadecimal digit according to the fifth and sixth columns of the Table 1-1.

Table 1-1 Binary, decimal, octal and hexadecimal numbers

Binary	Decimal	Octal	3-Bit String	Hexadecimal	4-Bit String
0	0	0	000	0	0000
1	1	1	001	1	0001
10	2	2	010	2	0010
11	3	3	011	3	0011
100	4	4	100	4	0100
101	5	5	101	5	0101
110	6	6	110	6	0110
111	7	7	111	7	0111
1000	8	10	—	8	1000
1001	9	11	—	9	1001
1010	10	12	—	A	1010
1011	11	13	—	B	1011
1100	12	14	—	C	1100

续表

Binary	Decimal	Octal	3-Bit String	Hexadecimal	4-Bit String
1101	13	15	—	D	1101
1110	14	16	—	E	1110
1111	15	17	—	F	1111

Thus, it is very easy to convert a binary number to octal number. Starting at the binary point and working left, we simply separate the bits into groups of three and replace each group with the corresponding octal digit.

$$100011001110_2=100\ 011\ 001\ 110_2=4316_8$$

$$11101101110101001_2=011\ 101\ 101\ 110\ 101\ 001_2=355651_8$$

The procedure for binary to hexadecimal conversion is similar, except we use groups of four bits.

$$100011001110_2=1000\ 1100\ 1110_2=8CE_{16}$$

$$11101101110101001_2=01\ 1101\ 1011\ 1010\ 1001_2=1DBA9_{16}$$

In these examples we have freely added zeroes on the left to make the total number of bits a multiple of 3 or 4 as required.

If a binary number contains digits to the right of the binary point, we can convert them to octal or hexadecimal number by starting at the binary point and working right. Both the left-hand and right-hand sides can be padded with zeroes to get multiples of three or four bits, as is shown in the example below:

$$10.1011001011_2=010\ .\ 101\ 100\ 101\ 100_2=2.5454_8$$

$$=0010\ .\ 1011\ 0010\ 1100_2=2.B2C_{16}$$

Converting in the reverse direction, from octal or hexadecimal to binary, is also very easy. We simply replace each octal or hexadecimal digit with the corresponding 3-bit or 4-bit string, as shown below:

$$1357_8=001\ 011\ 101\ 111_2$$

$$2046.17_8=010\ 000\ 100\ 110.001\ 111_2$$

$$BEAD_{16}=1011\ 1110\ 1010\ 1101_2$$

$$9F.46C_{16}=1001\ 111\ .0100\ 0110\ 1100_2$$

The octal number system was quite popular 25 years ago because of certain minicomputers that had their front-panel lights and switches arranged in groups of three. However, the octal number system is not used much today because of the preponderance of machines that process 8-bit bytes. It is difficult to extract individual byte values in multi-byte quantities in the octal representation. For example, what are the octal values of the four 8-bit bytes in the 32-bit number with octal representation 12345670123_8?

In the hexadecimal system, two digits represent an 8-bit byte, and 2n digits represent an

n-byte word; each pair of digits constitutes exactly one byte. For example, the 32-bit hexadecimal number $5678ABCD_{16}$ consists of four bytes with values 56_{16}, 78_{16}, AB_{16} and CD_{16}. In this context, a 4-bit hexadecimal digit is sometimes called a nibble; a 32-bit (4-byte) number has eight nibbles. Hexadecimal numbers are often used to describe a computer's memory address space. For example, a computer with 16-bit addresses might be described as having read/write memory installed at addresses $0\sim EFFF_{16}$ and read-only memory at addresses $F000\sim FFFF_{16}$. Many computer programming languages use the prefix "0x" to denote a hexadecimal number. For example, 0xBFC0000[1].

Words and Expressions

1.	radix	['rediks]	*n.*	①[数]根 ②[统]基数 ③[植]根
2.	binary	['bainəri]	*a.*	①二进制的 ②仅基于两个数字的，二元的
			n.	二进制数
3.	process	['prəuses]	*vt.*	①加工；处理 ②数据处理
4.	digital	['didʒitəl]	*a.*	数码的，数字信息系统的，数字的
			n.	数字电视，数字仪表
5.	circuit	['sə:kit]	*n.*	①电路，线路 ②环行，环行道
6.	purpose	['pə:pəs]	*n.*	①目的；意图 ②作用；用途
7.	provide	[prə'vaid]	*vt.*	提供，供应
8.	convenient	[kən'vi:njənt]	*a.*	①方便的，便利的 ②实用的
9.	representation	[ˌreprizen'teiʃən]	*n.*	①表示 ②代表
10.	multibit	[mʌltibit]	*a.*	多位的
11.	hexadecimal	['heksədesiməl]	*a.*	十六进制的
12.	integer	['intidʒə]	*n.*	整数
13.	octal	['ɔktl]	*a.*	八进制的
14.	equivalent	[i'kwivələnt]	*n.*	①相等的东西；等量 ②[数学]等价；等值
			a.	①相等的，相当的 ②等价的；等值的
15.	decimal	['desiməl]	*a.*	十进位的，小数的
			n.	小数
16.	supplement	['sʌplimənt]	*vt.*	增补，补充
			n.	①增补(物) ②(报纸的)增刊

17.	represent	[repri'zent]	*vt.*	①代表，表示　②相当于
18.	uniquely	[ju:'ni:kli]	*ad.*	独特地，唯一地
19.	combination	[kɔmbi'neiʃən]	*n.*	①结合，组合　②联合体，组合物
20.	column	['kɔləm]	*n.*	①[计算机]纵列，纵向排列　②纵行
21.	convert	[kən'və:t]	*vt.& vi.*	(使)转变，(使)转化
22.	replace	[ri'pleis]	*vt.*	①代替，替换　②(用……)替换
23.	separate	['sepəreit]	*vt.& vi.*	分开，隔离
			a.	个别的，各自的
24.	corresponding	[kɔri'spɔndiŋ]	*a.*	①对应的，相应的　②符合的，一致的
25.	procedure	[prə'si:dʒə]	*n.*	[计算机]过程，程序，步骤；算法
26.	conversion	[kən'və:ʃən]	*n.*	变换，转化
27.	require	[ri'kwaiə]	*vt.& vi.*	①需要　②要求；规定
28.	pad	[pæd]	*vt.*	填塞；封填
			n.	一捆；一束
29.	direction	[di'rekʃən]	*n.*	①方向，趋向　②指示，说明
30.	panel	['pænəl]	*n.*	(汽车或其他机械的)控制板，仪表盘
31.	switch	[switʃ]	*n.*	开关
			vt.& vi.	转变，改变
32.	arrange	[ə'reindʒ]	*vt.& vi.*	安排；准备
33.	preponderance	[pri'pɔndərəns]	*n.*	优势，主体
34.	extract	[iks'trækt]	*vt.*	①提取，提炼　②摘录；选录
35.	individual	[indi'vidjuəl]	*a.*	个别的，独特的
			n.	个人
36.	constitute	['kɔnstitju:t]	*vt.*	构成，组成
37.	nibble	['nibl]	*n.*	[计算机]半字节
38.	describe	[di'skraib]	*vt.*	①描述　②描绘，叙述，形容
39.	install	[in'stɔ:l]	*vt.*	①安装　②安顿，安置
40.	denote	[di'nəut]	*v.*	表示；意指
41.	prefix	['pri:fiks]	*n.*	前缀
			vt.	在……前加前缀
42.	a string of			一串，一行，一列
43.	take on			承担，接受，从事

44. according to　　按照，根据

45. because of　　因为，由于

46. consist of　　由……组成

Notes

(1) Radix 10 is important because we use it in everyday business, and radix 2 is important because binary numbers can be processed directly by digital circuits.

句中的 because 引导原因状语从句。because 引导的原因状语从句一般放于主句之后，because 表示直接原因，语气最强，最适合回答以 why 引导的疑问句。

(2) The octal number system uses radix 8, while the hexadecimal number system uses radix 16.

句中 while 作并列连词，译为“而，却”，表对照关系。

(3) Since a string of three bits can take on eight different combinations, it follows that each 3-bit string can be uniquely represented by one octal digit, according to the third and fourth columns of Table 1-1.

句中的 since 引导原因状语从句。since 引导的原因状语从句一般放于主句之前表示已知的、显然的理由(通常被翻译成“既然”)，较为正式，语气比 because 弱。

(4) The octal number system was quite popular 25 years ago because of certain minicomputers that had their front-panel lights and switches arranged in groups of three.

句中，关系代词 that 引导一个定语从句修饰 certain minicomputers，关系代词 that 在从句中作主语。

Word-Study

I. Binary

(1) (computing, mathematics) using only 0 and 1 as a system of numbers.

- the binary system
- binary arithmetic

(2) (technical) based on only two numbers; consisting of two parts.

- binary codes / numbers　二进制代码/数
- One million binary bits.　两个，双(两)个的东西，尤指双星。

II. Process, Processing

(1) **Process** means to treat raw material, food ,etc. in order to change it, preserve it etc.

(2) (computing) to perform a series of operations on data in a computer.

(3) **Processing** is a course on color photograph and processing.

Most of the food we buy is processed in some way.

processed cheese

a sewage processing plant

the food processing industry

III. Convenient, Convenience, Conveniently

(1) **Convenient** usually means easy or quick to do; not causing problems.

(2) **Convenience** is the quantity of being useful, easy or suitable for sb.

(3) **Conveniently** usually means easily or quickly to do; not causing problems.

It is very convenient to pay by card.

I'll call back at a more convenient time.

We have provided seats for the convenience of our customers.

In this resort you can enjoy all the comfort and convenience of modern tourism.

The report can be conveniently divided into three main sections.

The hotel is conveniently situated close to the beach and the shops.

IV. Representation, Represent

(1) **Representation** is the act of presenting sb./sth. in a particular way; something that shows or describes sth.

(2) **Represent** means[often passive] to be a member of a group of people and act or speak on their behalf at an event, a meeting, etc.

the negative representation of single mothers in the media

The snake swallowing its tail is a representation of infinity.

The competition attracted over 500 contestants representing 8 different countries.

The president was represented at the ceremony by the vice-president.

Sentence Patterns

Formal Subject "it"

It is { wrong to tell a lie. / no use arguing about it. / uncertain who will come.

It + be + adj.+ to do sth. / doing/ that ..	(1) It is very important to learn a foreign language. (2) It is useless crying over the spilt milk. (3) It was really surprising that she married a man like that.
It + be +n. (phr.) + doing / that …	(1) It is no good telling lies. (2) It is a pity that you didn't go to see the film yesterday. (3) It is a truth that there would be no new China without the Communist Party.

续表

It + be + past participle + that …(usually say, hope, think, suppose, expect, report, know, believe, decide, etc.)	(1) It is said that they have invented a new type of computer. (2) It is believed that China will become one of the strongest countries in the world. (3) It was reported that more than 170 thousand people died in the 2004 tsunami.
It + takes + (sb.) + some time + to do sth.	(1) It took me some time to read the reading materials. (2) How long does it take you to go to Beijing from Qingdao by train?
It + seems / appears / happens, etc. (intransitive verb) + that …	(1) It seems that he enjoys pop songs very much. (2) It appears that Tom might change his mind.
Interrogative Sentences	(1) Does it matter much that they won't come tomorrow? (2) Is it true that he will go abroad next week?

Exercises

Ⅰ. Answer the following questions with the information from the passage.

1. Why are radix 10 and radix 2 important?
2. What the octal number system and the hexadecimal system use?
3. How many digits do the octal system and the hexadecimal system need?
4. What can each 3-bit string and a 4-bit string be represented by?
5. How can we convert a binary number to octal?
6. How can we convert a binary number to octal or hexadecimal, if a binary number contains to the right of the binary point?
7. What is converting in the reverse direction, from octal or hexadecimal?
8. Why was the octal number system quite popular 25 years ago?
9. What do two digits represent in the hexadecimal system?
10. What do many computer programming languages use to denote a hexadecimal number?

Ⅱ. Complete the following sentences with phrases and expressions given below.

A. be useful for **B.** replace … with… **C.** convert … to… **D.** consist of **E.** according to

1. We've __________ the old adding machine __________ a computer.
2. All electronic computers __________ five units although they are of different kinds.
3. Courses taken that would __________ computer programming are Computer science, systems design and analysis, FORTRAN programming, PASCAL programming, operating systems, systems management.
4. __________ expert opinions, they gave up the experiment immediately.
5. __________code __________ ordinary language.

Ⅲ. Fill in the blanks with the words given below. Change the form when necessary.

process	convenient	uniquely	require	arrange	extract

1. The computer enables people to communicate with each other more _________.
2. Your _________ that she wait till next week is reasonable.
3. How fast does the computer _________ the data?
4. A computer word that specifies to _________ some parts of another computer word.
5. I have _________ that one of my staff will meet you at the airport.
6. He's caught the _________ opportunity.

Ⅳ. Choose an appropriate translation from Column B for each of the words in Column A.

		Column A		Column B
( )	1.	binary number	A.	基数
( )	2.	octal number	B.	十六进制
( )	3.	hexadecimal number	C.	半字节
( )	4.	decimal number	D.	八进制
( )	5.	Radix	E.	十进制
( )	6.	Nibble	F.	电路
( )	7.	multi-byte	G.	二进制
( )	8.	Circuit	H.	多字节

Reading 1: Positional Number Systems

The traditional number system that we learned in school and use every day in business is called a positional number system. In such a system, a number is represented by a string of digits where each digit position has an associated weight. The value of a number is a weighted sum of the digits, for example

$$1734=1\times1000+7\times100+3\times10+4\times1$$

Each weight is a power of 10 corresponding to the digit's position. A decimal point allows negative as well as positive powers of 10 to be used, for example

$$5185.68\ \ 5\times1000+1\times100+8\times10+5\times1+6\times0.1+8\times0.01$$

In general, a number D of the form $d_1d_0.d_{1}d_{-2}$ has the value

$$D=d_1\times10^1+d_0\times10^0+d_{1}\times10^{1}+d_{-2}\times10^{2}$$

Here 10 is called the base or radix of the number system. In a general positional number system, the radix may be any integer $r\geqslant2$ and a digit in position i has weight r^i. The general form of a number in such a system is

$$dp_{1}\,dp_{2}\ldots d_1d_0.d_{1}d_{-2}\ldots d_{n}$$

where there are p digits to the left of the point and n digits to the right of the point, "." is called the radix point. If the radix point is missing, it is assumed to be to the right of the rightmost digit. The value of the number is the sum of each digit multiplied by the corresponding power of the radix

$$D = \sum_{i=-n}^{p-1} d_i \cdot r^i$$

Except for possible leading and trailing zeroes, the representation of a number in a positional number system is unique. (Obviously, 0185.6300 equals 185.63, and so on.) The leftmost digit in such a number is called the high-order or most significant digit; the rightmost is called the low-order or least significant digit.

Digital circuits have signals that are normally in one of only two conditions—low or high, charged or discharged, off or on. The signals in these circuits are interpreted to represent binary digits (or bits) that have one of two values, 0 and 1. Thus, the binary radix is normally used to represent numbers in a digital system. The general form of a binary number is

$$b_{p-1}\, b_{p-2} \ldots b_1 b_0 . b_{-1} b_{-2} \ldots b_{-n}$$

and its value is

$$B = \sum_{i=-n}^{p-1} b_i \cdot 2^i$$

In a binary number, the radix point is called the binary point. When dealing with binary and other nondecimal numbers, we often use a subscript to indicate the radix of each number, unless the radix is clear from the context. Examples of binary numbers and their decimal equivalents are given below.

$$10011_2=1\times16+0\times8+0\times4+1\times2+1\times1=19_{10}$$

$$100010_2=1\times32+0\times16+0\times8+0\times4\times1+2+0\times1=34_{10}$$

$$101.001_2=1\times4+0\times2+1\times1+0\times0.5+0\times0.25+1\times0.125=5.125_{10}$$

The leftmost bit of a binary number is called the high-order or most significant bit (MSB); the rightmost is the low-order or least significant bit (LSB)[1].

Unit 2

Text 2: Floating-Point Numbers

Floating-point notation can be used conveniently to represent both large as well as small fractional or mixed numbers. This makes the process of arithmetic operations on these numbers relatively much easier. Floating-point representation greatly increases the range of numbers, from the smallest to the largest, that can be represented using a given number of digits. Floating-point numbers are in general expressed in the following form

$$N = m \times b^e \tag{2.1}$$

Where m is the fractional part, called the significant or mantissa, e is the integer part, called the exponent and b is the base of the number system or numeration. Fractional part m is a p-digit number of the form (±d.dddd…dd), with each digit d being an integer between 0 and $b-1$ inclusive. If the leading digit of m is nonzero, then the number is said to be normalized.

According to equation (2.1), in the case of decimal, hexadecimal and binary number systems can be written as follows:

Decimal system

$$N = m \times 10^e \tag{2.2}$$

Hexadecimal system

$$N = m \times 16^e \tag{2.3}$$

Binary system

$$N = m \times 2^e \tag{2.4}$$

For example, decimal numbers 0.0003754 and 3754 will be represented in floating-point notation as 3.754×10^{-4} and 3.754×10^{3} respectively. A hexadecimal number 257. ABF will be represented as $2.57\text{ABF}\times16^{2}$. In the case of normalized binary numbers, the leading digit, which is the most significant bit, is always '1' and thus it does not need to be stored explicitly.

Similarly, while expressing a given mixed binary number as a floating-point number, the radix point is so shifted as to have the most significant bit immediately to the right of the radix point as a '1'. Both the mantissa and the exponent can have a positive or a negative value.

The mixed binary number $(110.1011)_2$ will be represented in floating-point notation as $.1101011\times2^{3}$ .1101011e+0011. Here, .1101011 is the mantissa and e+0011 implies that the exponent is +3. As another example, $(0.000111)_2$ will be written as .111e−0011, with .111 being

the mantissa and e−0011 implying an exponent of 3. Also, $(-0.00000101)_2$ may be written as $-.101\times 2^{\ 5}=-.101e-0101$, where −.101 is the mantissa and e−0101 indicates an exponent of −5. If we wanted to represent the mantissas by using eight bits, then .1101011 and .111 would be represented as .11010110 and .11100000[2].

Words and Expressions

1.	notation	[nəu'teiʃən]	*n.*	标记法；(数学、科学和音乐中的)符号
2.	fractional	['frækʃənəl]	*a.*	①微不足道的，极小的，极少的 ②分数的；小数的
3.	arithmetic	[ə'riθmətik]	*n.*	①算术 ②计算 ③算术运算；四则运算
4.	relatively	['relətivli]	*ad.*	相当程度上，相当地；相对地
5.	range	[reindʒ]	*n.*	(变动或浮动的)范围，界限，区域
6.	significant	[sig'nifikənt]	*n.*	①有意义的事物 ②象征，标志
			a.	①有重大意义的 ②显著的
7.	numeration	[nju:mə'reiʃən]	*n.*	计算，编号，读数法
8.	inclusive	[in'klu:siv]	*a.*	①包括……的 ②范围广泛的
9.	equation	[i'kweiʃən]	*n.*	①方程式，等式 ②相等，平衡
10.	respectively	[ri'spektivli]	*ad.*	各自地，分别地
11.	normalized	['nɔ:məlaizd]	*a.*	规范化的，规格化的
12.	explicitly	[ik'splisitli]	*ad.*	明白地，明确地
13.	imply	[im'plai]	*vt.& vi.*	①暗示，暗指 ②说明，表明
14.	indicate	['indikeit]	*vt.*	表明，表示
15.	as well as			(除……之外)也，又
16.	in the case of			就……来说；在……的情况下

Notes

(1) Floating-point notation can be used conveniently to represent both large as well as small fractional or mixed numbers.

句中短语 be used to do 意思是“被用来做……”，as well as 意思是“也”。

(2) Where m is the fractional part, called the significant or mantissa, e is the integer part, called the exponent and b is the base of the number system or numeration.

句中 call 意思是“称为”。

(3) Similarly, while expressing a given mixed binary number as a floating-point number, the radix point is so shifted as to have the most significant bit immediately to the right of the radix point as a ‘1’.

句中的 while 引导时间状语从句，意思是“当……时候”。

Word-Study

I. Relatively，Relative，Relativity

(1) **Relatively** means to a fairly large degree, especially in comparison to others.

(2) **Relative** means to consider according to its position or connection with sth. else.

(3) **Relative** means a person who is in the same family as sb. else.

(4) **Relativity** is Einstein's theory of the universe based on the principle that all movement is relative and that time is a fourth dimension related to space.

(5) **Relativity** is (formal) the state of being relative and only able to be judged when compared with sth. else.

I found the test relatively easy.

We had relatively few applications for the job.

Relatively speaking, these jobs provide good salaries.

All human values are relative, so beauty is relative to the beholder's eyes.

a close/distant relative

Have you got any relatives or friends abroad?

the general/special theory of relativity

II. Significant, Significantly, Significance, Signify

(1) **Significant** means large or important enough to have an effect or to be noticed.

(2) **Significantly** means in a way that is large or important enough to have an effect or to be noticed; OPP insignificantly.

(3) **Significance** means the importance of sth., especially when this has an effect on what happens in the future; OPP insignificance.

(4) **Significance** means the meaning of sth.

(5) **Signify** means to be a sin of sth.; to mean sth.

There are no significant differences between the two groups of students.

Your work has shown a significant improvement.

The two sets of figures are not significantly different from each other.

Profits have increased significantly over the past few years.
The new drug has great significance for the treatment of the disease.
We should be fully aware of the significance of television in shape our ideas.
She couldn't grasp the full significance of what he had said.
Do these symbols have any particular significance?
He signified consent of his daughter remarriage by nodding.
It signifies little.

Sentence Patterns

Make

<table>
<tr><td>make + n. + the Infinitive</td><td colspan="2">(1) She made all of us laugh.
(2) We were made to laugh by her.</td></tr>
<tr><td>make + adj.(phr.)+ n. phr.</td><td colspan="2">The telescope made possible the observation of the far-off stars.</td></tr>
<tr><td>make + it + a. + the infinitive (clause)</td><td colspan="2">(1) In order to make it easier for people to use computers, languages for writing programs have been devised.
(2) The company made it questionable whether the equipment should be employed at all.</td></tr>
<tr><td rowspan="3">Make means do or produce</td><td>make sth. (to do sth.)</td><td>She can make kites.</td></tr>
<tr><td>make sb. (sth.)/make sth. for sb.</td><td>(1) His mother made him a beautiful coat.
(2) His mother made a beautiful coat for him.</td></tr>
<tr><td>be made of/from, be made in, be made by</td><td>(1) Wine is made from grapes.
(2) These cars were made in Changchun.</td></tr>
<tr><td rowspan="2">Make means bring or cause</td><td>make + sb./sth. + a.</td><td>(1) The news made him happy.
(2) Computers make it easier to learn English.
(2) They all want to make Jim their monitor.
(3) I spoke loudly in order to make my voice heard.</td></tr>
<tr><td>make + sb./ sth. + the infinitive (omit to)</td><td>(1) Our English teacher often makes us retell the texts.
(2) We are often made to retell the texts (by our English teacher).</td></tr>
<tr><td>Phrases about make</td><td colspan="2">make a decision, make a face/faces, make friends with, make progress, make sure, make up one's mind, etc.</td></tr>
</table>

Exercises

Ⅰ. Answer the following questions with the information from the passage.

1. What can floating-point notation be used conveniently to represent?

2. What dose floating-point representation greatly increase?

3. What will be the equation in the case of decimal, hexadecimal and binary number systems be written?

4. What will a decimal number 0.0003754 and a hexadecimal number 257. ABF be represented in floating-point notation?

5. What is the leading digit in the case of normalized binary numbers?

6. What can both the mantissa and the exponent have?

7. What will the binary number $(110.1011)_2$ be represented in floating-point notation?

Ⅱ. Choose an appropriate translation from Column B for each of the words in Column A.

		Column A		Column B
( )	1.	floating-point notation	A.	尾数
( )	2.	arithmetic operations	B.	小数
( )	3.	mantissa	C.	正数
( )	4.	floating-point numbers	D.	算术操作
( )	5.	exponent	E.	整数
( )	6.	the fractional part	F.	浮点计数法
( )	7.	the integer part	G.	浮点数
( )	8.	a positive value	H.	指数

Ⅲ. Complete the following sentences with phrases and expressions given below.

A. as well as **B.** in the case of **C.** between… and… **D.** be represented as **E.** be said to

1. Children must attend school ________ 5 ________ 16.
2. The king ________ a villain in the play.
3. Action ________ thought is necessary.
4. What Jim said can ________ be an excuse.
5. Break the circuit first ________ fire.

Ⅳ. Fill in the blanks with the words given below. Change the form when necessary.

relatively	significant	equation	normalize	imply	respectively

1. He ________ success with material wealth.
2. Let's make a ________ study of the two languages.
3. Freedom does not necessarily ________ responsibility.
4. This fact has little ________ for us.
5. A binary-coded decimal code for representing decimal numbers in which each decimal digit is represented by seven binary digits which are coefficients of 8,6,4,2,0,1,0, ________.
6. He received four years of ________ education at college.

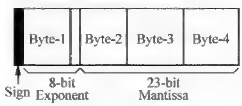
Reading 2: ANSI/IEEE-754 Format

The IEEE-754 floating point is the most commonly used representation for real numbers on computers including Intel-based personal computers, Macintoshes and most of the UNIX platforms. It specifies four formats for representing floating-point numbers. These include single-precision, double-precision, single-extended precision and double-extended precision formats. Table 2-1 lists characteristic parameters of the four formats contained in the IEEE-754 standard. Of the four formats mentioned, the single-precision and double-precision formats are the most commonly used ones. But the single-extended and double-extended precision formats are not common.

Table 2-1 Characteristic parameters of IEEE-754 formats

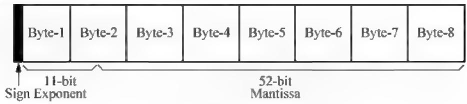
Precision	Sign/bits	Exponent/bits	Mantissa/bits	Total length/bits	Decimal digits of precision
Single	1	8	23	32	>6
Single-extended	1	≥11	≥32	≥44	>9
Double	1	11	52	64	>15
Double-extended	1	≥15	≥64	≥80	>19

Fig. 2.1 shows the basic constituent parts of the single-precision and double-precision formats. As shown in the figure, the floating-point numbers, as represented using these formats, have three basic components including the sign, the exponent and the mantissa. In the sign bit, '0' denotes a positive number and '1' denotes a negative number. The n-bit exponent field needs to represent both positive and negative exponent values. To achieve this, a bias equal to $2^{n-1}-1$ is added to the actual exponent in order to obtain the stored exponent. This equals 127 for an 8-bit exponent of the single-precision format and 1023 for an 11-bit exponent of the double-precision format. The addition of bias allows the use of an exponent in the range from −127 to +128, corresponding to a range of 0~255 in the first case, and in the range from −1023 to +1024, corresponding to a range of 0~2047 in the second case. A negative exponent is always represented in 2's complement form. The single-precision format offers a range from 2^{127} to 2^{+127}, which is equivalent to 10^{38} to 10^{+38}. The figures are 2^{1023} to 2^{+1023}, which is equivalent to 10^{-308} to 10^{+308} in the case of the double-precision format.



(a) Single-precision format

Fig. 2.1 Single-precision and double-precision formats



(b) Double-precision format

Fig. 2.1 Single-precision and double-precision formats(continued)

The extreme exponent values are reserved for representing special values. For example, in the case of the single-precision format, for an exponent value of −127, the biased exponent value is zero, represented by an all 0s exponent field. In the case of a biased exponent of zero, if the mantissa is zero as well, the value of the floating-point number is exactly zero. If the mantissa is nonzero, it represents a denormalized number that does not have an assumed leading bit of '1'. A biased exponent of +255, corresponding to an actual exponent of +128, is represented by an all 1s exponent field. If the mantissa is zero, the number represents infinity. The sign bit is used to distinguish between positive and negative infinity. If the mantissa is nonzero, the number represents a 'NaN' (Not a Number). The value NaN is used to represent a value that does not represent a real number. This means that an 8-bit exponent can represent exponent values between −126 and +127. Referring to Fig. 2.1(a), the MSB of byte 1 indicates the sign of the mantissa. The remaining seven bits of byte 1 and the MSB of byte 2 represent an 8-bit exponent. The remaining seven bits of byte 2 and the 16 bits of byte 3 and byte 4 give a 23-bit mantissa. The mantissa *m* is normalized. The left-hand bit of the normalized mantissa is always '1'. This '1' is not included but is always implied. A similar explanation can be given in the case of the double-precision format shown in Fig. 2.1(b).

Step-by-step transformation of $(23)_{10}$ into an equivalent floating-point number in single-precision IEEE-745 format is as follows:

(1) $(23)_{10}$=$(10111)_2$=1.0111e+0100.

(2) The mantissa=0111000 00000000 00000000.

(3) The exponent=00000100.

(4) The biased exponent=00000100+01111111=10000011.

(5) The sign of the mantissa=0.

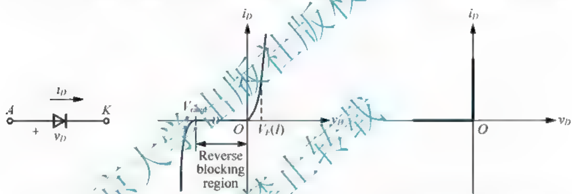
(6) $(+23)_{10}$=01000001 10111000 00000000 00000000.

(7) Similarly, $(-23)_{10}$=11000001 10111000 00000000 00000000[2].

Unit 3

Text 3: Diodes

Fig. 3.1(a) and Fig. 3.1(b) show the circuit symbol for the diode and its steady-state i–v characteristic. When the diode is forward biased, it begins to conduct with only a small forward voltage across it, which is on the order of 1 V. When the diode is reverse biased, only a negligibly small leakage current flows through the device until the reverse breakdown voltage is reached. In normal operation, the reverse-bias voltage should not reach the breakdown rating.



(a) Symbol (b) i–v characteristics (c) Idealized characteristics

Fig. 3.1 Diode

In view of the very small leakage currents in the blocking (reverse-bias) state and the small voltage in the conducting (forward-bias) state as compared to the operating voltage and currents of the circuit in which the diode is used, the i–v characteristics for the diode can be idealized, as shown in Fig. 3.1(c). This idealized characteristic can be used for analyzing the converter topology, but it should not be used for the actual design, especially when the heat sink requirements for the device are being estimated.

At turn-on, the diode can be considered an ideal switch because it turns on rapidly compared to the transients in the power circuit. However, at turn-off, the diode current reverses for a reverse-recovery time t_{rr}, as is indicated in Fig. 3.2, before falling to zero. This reverse-recovery (negative) current is required to sweep out the excess carriers in the diode and allow it to block a negative polarity voltage. The reverse-recovery current can lead to overvoltages in inductive circuits. In most circuits, this reverse current does not affect the converter input/output characteristic and so the diode can also be considered as ideal during the turn-off transient.

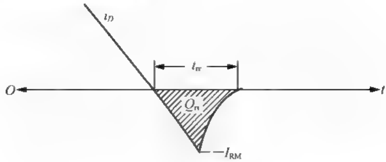


Fig. 3.2 Diode turn-off

Depending on the application requirements, various types of diodes are available:

(1) Schottky diodes. These diodes are used where a low forward voltage drop (typically 0.3 V) is needed in very low output voltage circuits. These diodes are limited in their blocking voltage capabilities to 50~100 V.

(2) Fast-recovery diodes. These are designed to be used in high-frequency circuits in combination with controllable switches where a small reverse-recovery time is needed. At power levels of several hundred volts and several hundred amperes, such diodes have t_{rr} ratings of less than a few microseconds.

(3) Line-frequency diodes. The on-state voltage of these diodes is designed to be as low as possible and as a consequence have larger t_{rr}, which are acceptable for line-frequency applications. These diodes are available with blocking voltage ratings of several kilovolts and current ratings of several kiloamperes. Moreover, they can be connected in series and parallel to satisfy any voltage and current requirement[5].

Words and Expressions

1.	diode	['daiəud]	*n.*	二极管
2.	compare	[kəm'peə]	*v.*	对比，比较
3.	analyze	['ænəlaiz]	*v.*	分析
4.	converter	[kən'və:tə]	*n.*	转换器，变频器
5.	topology	[təu'pɔlədʒi]	*n.*	①(集成电路元件的)布局(技术) ②拓扑学
6.	transient	['trænziənt]	*n.*	瞬态[变量在两个稳态间转变的过程]
7.	carrier	['kæriə]	*n.*	①载体[波]；媒体(数据) ②载流子
8.	excess	[ik'ses]	*a.*	①额外的 ②过量的，超额的 ③附加的 ④过度的
9.	polarity	[pəu'læriti]	*n.*	①极性(现象) ②偏振[PO]

10.	overvoltage	['əuvə'vəultidʒ]	*n.*	超电压，过电压
11.	inductive	[in'dʌktiv]	*a.*	电感的，磁感的
12.	circuit	['sə:kit]	*n.*	线路，电路
13.	input	['input]	*v.*	输入
14.	output	['autput]	*v.*	输出
15.	available	[ə'veiləbl]	*a.*	①可用的　②有效的　③存在的
16.	capability	[keipə'biliti]	*n.*	①能力，本领　②权能(操作系统用)
17.	requirement	[ri'kwaimənt]	*n.*	①要求，需求　②必要条件
18.	ampere	['æmpeə]	*n.*	[电]安培
19.	microsecond	['maikrəsekənd]	*n.*	微秒
20.	parallel	['pærəlel]	*a.*	[电子学、计算机]并联的
21.	power level			功率位准，功率级
22.	*i*–*v* characteristic			伏安特性
23.	forward biased			正偏，正向偏置
24.	reverse biased			反偏，反向偏置
25.	leakage current			漏电电流
26.	sweep out			去除，扫掉
27.	excess carriers			过剩载流子
28.	in combination with			与……结合

Notes

(1) In view of the very small leakage currents in the blocking (reverse-bias) state and the small voltage in the conducting (forward-bias) state as compared to the operating voltage and currents of the circuit in which the diode is used, the *i*–*v* characteristics for the diode can be idealized, as shown in Fig. 3.l(c).

① in view of：考虑到……，由于……

② blocking state：闭塞或阻塞状态。

③ conducting state：通导状态。

④ 这是一个比较复杂的句式。主要说明的是二极管(Diode)应用的环境和状态。正确分析句子中的成分，对于理解该句非常必要。这里 in which=where，实际上是 where 引导的一个状语从句，恰好交代了二极管应用的环境和状态。

(2) Schottky diodes (肖特基二极管)。肖特基二极管，又称肖特基势垒二极管(SBD)，它属一种低功耗、超高速半导体器件。最显著的特点为反向恢复时间极短(可以小到几纳秒)，

正向导通压降仅 0.4V 左右。其多用作高频、低压、大电流整流二极管、续流二极管、保护二极管，也有的用在微波通信等电路中作整流二极管、小信号检波二极管使用。在通信电源、变频器等中比较常见。

(3) Fast-recover diodes(快速恢复二极管)。快速恢复二极管是介于肖特基和普通二极管之间的二极管，它既像肖特基二极管一样导通压降低(没有肖特基低)，且速度快，又有比较高的耐压(肖特基一般耐压很低)。它主要用于频率较高的场合做整流。例如，开关电源的二次整流、市电的整流，采用快恢复二极管都没有问题，但由于快恢复二极管材料和工艺的原因，它的 PN 结较普通整流管要薄，过瞬间大电流的能力较普通的二极管弱，尤其是在滤波电容过大的情况下，管子最大电流选择不当会在一瞬间烧毁快恢复二极管的 PN 结。

Sentence Patterns

Ⅰ. allow + sb.+ the infinitive

allow + (doing) sth
allowe sb to do
allow sb sth
Notice: we can use allow (doing) sth, but never say allow to do sth.
(1) The definition of diodes allows no other explanation.
(2) Little child don't allow touching electricity.
(3) My parents don't allow me to go out at night.
(4) Her boss doesn't allow her to use the telephone.
(5) Two jobs allow me an apartment, food and child care payment.
(6) We'll allow you time to answer.
(7) I will allow you 10% off the price if you pay now.
(8) This experiment allows scientist to change glass from insulator to conductor.

Ⅱ. Substitutable

Here are some useful phrases with the same sense which can be substitutable in sentences.

Generally speaking, the metal	can	be considered as	fluidity
At turn-on, the diode can		be regarded as	an ideal switch
Any type of analog filter		be viewed as	a lowpass, highpass, bandpass or a stepband filter
Generally speaking, the metal	can	be considered as/ be regarded as/ be viewed as	fluidity
At turn-on, the diode can			an ideal switch
Any type of analog filter			a lowpass, highpass, bandpass or a stopband filter

Exercises

Ⅰ. Answer the following questions with the information from the passage.

(1) When does the diode begin to conduct? And how many volts are needed?
(2) When can the diode be considered an ideal switch? And why?
(3) What's the function of the reverse-recovery (negative) current?
(4) In this passage, how many diodes are mentioned? And what are they?
(5) How to define the above diodes?

Ⅱ. Choose an appropriate translation from Column B for each of the words in Column A.

		Column A		Column B
( )	1.	ampere	A.	应用
( )	2.	topology	B.	[电子学、计算机]并联的
( )	3.	analyze	C.	分析
( )	4.	parallel	D.	[电]安培
( )	5.	polarity	E.	(集成电路元件的)布局(技术)；拓扑学
( )	6.	inductive	F.	反偏，反向偏置
( )	7.	capability	G.	极性(现象)；偏振[PO]
( )	8.	application	H.	取决于……
( )	9.	input	I.	二极管
( )	10.	diodes	J.	载体[波]，媒体(数据)；载流子
( )	11.	carrier	K.	能力，本领；权能(操作系统用)
( )	12.	i–v characteristic	L.	去除，扫掉
( )	13.	revere biased	M.	电感的，磁感的
( )	14.	depend on	N.	伏安特性
( )	15.	sweep out	O.	输入

Ⅲ. Fill in the blanks with the words given below. Change the form when necessary.

input	excess	require	capability	compare	analyze

(1) Your _______ that she wait till next week is reasonable.
(2) Organizing a whole department is beyond his _______.
(3) Have you _______ the new data yet?
(4) This paper mainly _______ the fundamental concepts about the plastic design method.
(5) You'll have to pay _______ postal charges on this letter.
(6) It's interesting to _______ these two results of experiments.

Ⅳ. Complete the following sentences with phrases and expressions given below.

A. sweep out **B.** depend on **C.** in combination with **D.** be used for **E.** make use of

(1) This machine works and receives signals when it is _______ the controller.

(2) The error in this program needs to be well _______.

(3) The new device _______ detecting drug.

(4) That _______ how to tackle the problem.

(5) We should _______ our school facilities to build up our bodies.

Reading 3: Power Converters

The power electronic system of Fig. 3.3 usually consist of more than one power conversion stage (as shown in Fig. 3.4) where the operation of these stages is decoupled on an instantaneous basis by means of energy storage elements such as capacitors and inductors. Therefore, the instantaneous power input does not have to equal the instantaneous power output. We will refer to each power conversion stage as a converter. Thus, a converter is a basic module (building block) of power electronic systems. It utilizes power semiconductor devices controlled by signal electronics (integrated circuits) and possibly energy storage elements such as inductors and capacitors. Based on the form (frequency) on the two sides, converters can be divided into the following categories.

(1) AC to DC.

(2) DC to AC.

(3) DC to DC.

(4) AC to AC.

We will use converter as a generic term to refer to a single power conversion stage that may perform any of the functions listed above. To be more specific, in AC to DC and DC to AC conversion, rectifier refers to a converter when the average power flow is from the AC to the DC side. Inverter refers to the converter when the average power flow is from the DC to the AC side. In fact, the power flow through the converter may be reversible. In that case, as shown in Fig. 3.5, we refer to that converter in terms of its rectifier and inverter modes of operation.

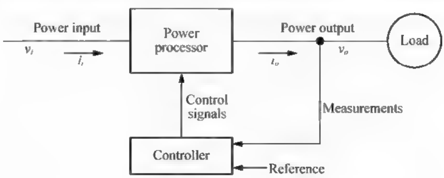


Fig. 3.3 Block diagram of a power electronic system

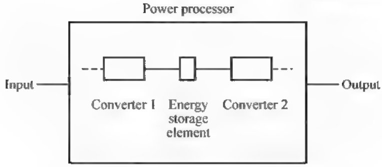


Fig. 3.4 Power processor block diagram

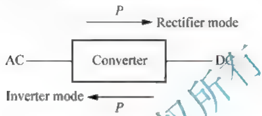


Fig. 3.5 ac-to-dc converters.

As an example, consider that the power processor of Fig. 3.4 represents the block diagram of an adjustable-speed AC motor drive. As shown in Fig. 3.6, it consists of two converters: converter 1 operating as a rectifier that converts line-frequency AC into DC and converter 2 operating as an inverter that converts DC into adjustable-frequency AC. The flow of power in the normal (dominant) mode of operation is from the utility input source to the output motor load. During regenerative braking, the power flow reverses direction (from the motor to the utility), in which case converter 2 operates as a rectifier and converter 1 operates as an inverter. As mentioned earlier, an energy storage capacitor in the DC link between the two converters decouples the operation of the two converters on an instantaneous basis. Further insight can be gained by classifying converters according to how the devices within the converter are switched. There are three possibilities.

(1) Line frequency (naturally commutated) converters, where the utility line voltages present at one side of the converter facilitate the turn-off of the power semiconductor devices. Similarly, the devices are turned on, phase locked to the linevoltage waveform. Therefore, the devices switch on and off at the line frequency of 50 Hz or 60 Hz.

(2) Switching (forced-commutated) converters, where the controllable switches in the converter are turned on and off at frequencies that are high compared to the line frequency. In spite of the high switching frequency internal to the converter, the converter output may be either DC or at a frequency comparable to the line frequency. As a side note in a switching converter, if the input appears as a voltage source, then the output must appear as a current source, or vice versa.

(3) Resonant and quasi-resonant converters, where the controllable switches turn on and/or turn off at zero voltage and/or zero current[3].

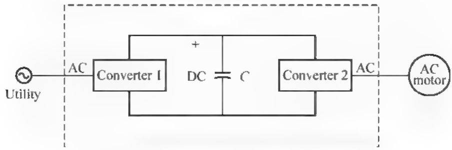
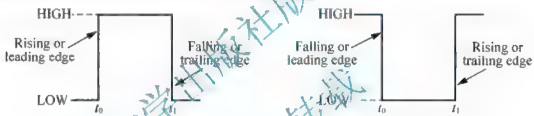


Fig. 3.6 Work diagram of an ac motor drive

Unit 4

Text 4: Digital Waveforms

Digital waveforms consist of voltage levels that are changing back and forth between the **HIGH** and **LOW** levels or states. Fig. 4.1(a) shows that a single positive-going pulse is generated when the voltage (or current) goes from its normally **LOW** level to its **HIGH** level and then back to its **LOW** level. The negative-going pulse in Fig. 4.1(b) is generated when the voltage goes from its normally **HIGH** level to its **LOW** level and back to its **HIGH** level. A digital waveform is made up of a series of pulses.



(a) Positive going pulse (b) Negative going pulse

Fig. 4.1 Ideal pulses

The Pulse: As indicated in Fig. 4.1(a), a pulse has two edges: a **leading edge** that occurs first at time t_0 and a **trailing edge** that occurs last at time t_1. For a positive-going pulse, the leading edge is a rising edge, and the trailing edge is a falling edge. The pulses in Fig. 4.1 are ideal because the rising and falling edges are assumed to change in zero time (instantaneously). In practice, these transitions never occur instantaneously, although for most digital work you can assume ideal pulses.

Fig. 4.2 shows a nonideal pulse. In reality, all pulses exhibit some or all of these characteristics. The overshoot and ringing are sometimes produced by stray inductive and capacitive effects. The droop can be caused by stray capacitive and circuit resistance, forming an RC circuit with a low time constant.

The time required for a pulse to go from its **LOW** level to its **HIGH** level is called the **rise time** (t_r), and the time required for the transition from the **HIGH** level to the **LOW** level is called the **fall time** (t_f). In practice, it is common to measure rise time from 10% of the pulse **amplitude** (height from baseline) to 90% of the pulse amplitude and to measure the fall time from 90% to 10% of the pulse amplitude, as indicated in Fig. 4.2. The bottom 10% and the top

10% of the pulse are not included in the rise and fall times because of the nonlinearities in the waveform in these areas. The **pulse width** (t_w) is a measure of the duration of the pulse and is often defined as the time interval between the 50% points on the rising and falling edges, as indicated in Fig. 4.2.

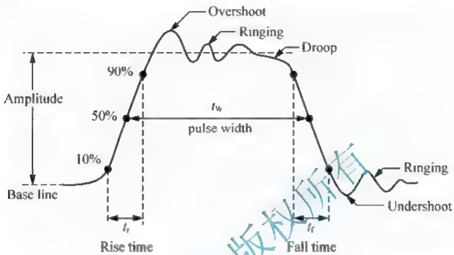
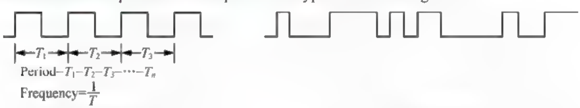


Fig. 4.2 Nonideal pulse characteristics

Waveform Characteristics: Most waveforms encountered in digital systems are composed of a series of pulses, sometimes called pulse trains and can be classified as either periodic or nonperiodic. A **periodic** pulse waveform is one that repeats itself at a fixed interval, called a **period** (T). The **frequency** (f) is the rate at which it repeats itself and is measured in hertz (Hz). A nonperiodic pulse waveform, of course, does not repeat itself at fixed intervals and may be composed of pulses of randomly differing pulse widths and/or randomly differing time intervals between the pulses. An example of each type is shown in Fig. 4.3.



(a) Periodic(square wave) (b) Nonperiodic

Fig. 4.3 Examples of digital waveforms

The frequency (f) of a pulse (digital) waveform is the reciprocal of the period. The relationship between frequency and period is expressed as follows:

$$f = \frac{1}{T} \tag{4.1}$$

$$T = \frac{1}{f} \tag{4.2}$$

An important characteristic of a periodic digital waveform is its duty cycle, which is the

ratio of the pulse width (t_w) to the period (T). It can be expressed as a percentage[4].

$$\text{Duty cycle}=\frac{t_w}{T}100\% \qquad (4.3)$$

Words and Expressions

1.	positive-going		*a.*	正向的
2.	negative-going		*a.*	负向的
3.	pulse	[pʌls]	*n.*	①脉冲　②脉搏，(心的)一次跳动
4.	assumed	[ə'su:md]	*a.*	假定的，假设的，设想的
5.	instantaneously	[instən'teinjəsli]	*ad.*	①即刻地　②突如其来地
6.	transition	['trænzeiʃənt]	*n.*	过渡(过程)，转变，迁移，转换
7.	overshoot	[ˌəuvə'ʃu: t]	*n.*	超调，超过
8.	ringing	['riŋiŋ]	*n.*	鸣震，震荡
9.	stray	[strei]	*n.*	①杂散，寄生　②走失，离群，迷路
10.	droop	[dru:p]	*n.*	固定偏差
11.	resistance	[ri'zistəns]	*n.*	①电阻　②抵抗，反抗　③抵抗能力
12.	constant	['kɔnstənt]	*n.*	①常数　②常量；不变的事物
			a.	始终如一的；恒久不变的
13.	amplitude	['æmplitju:d]	*n.*	①振幅　②广大，广阔　③充足，丰富
14.	nonlinearity	[nɔnlini'æriti]	*n.*	非线性
15.	width	[widθ]	*n.*	宽度，栏宽
16.	duration	[djuə'reiʃən]	*n.*	①持续时间；(时间的)持续，连续　②[语音学]音长，音延
17.	interval	['intəvəl]	*n.*	①时间间隔，区间　②(戏剧、电影或音乐会的)幕间休息，休息时间
18.	periodic	[ˌpiəri'ɔdik]	*a.*	周期性的，以规则的间隔时间反复的
19.	nonperiodic	['nɔnpiəri'ɔdik]	*a.*	非周期性的
20.	frequency	['fri:kwənsi]	*n.*	①(声波或无线电波的)振动频率，波段　②(某事发生可重复的)频率
21.	hertz(Hz)	[hə:ts]	*n.*	[电]赫，赫兹(频率单位)
22.	randomly	['rændəmli]	*ad.*	随机地，无规则地
23.	reciprocal	[ri'siprəkəl]	*n.*	①互逆[反]，可逆　②倒数

24.	digital waveform	数字波形
25.	a series of	一系列……
26.	a leading edge	(脉冲)前沿，上升边线[LE]
27.	a trailing edge	(脉冲)后沿，下降边线[TE]
28.	pulse trains	脉冲串
29.	be classified as	归类称为……
30.	duty cycle	占空比[序列脉冲信号的保持时间与其周期之比]

Notes

(1) 本章重点介绍了数字波形的构成、特性，并介绍了很多重要的概念，如脉冲、占空比等。

(2) duty cycle (占空比)。其有如下含义：①在一串理想的脉冲序列中(如方波)，正脉冲的持续时间与脉冲总周期的为占空比比值，例如，脉冲宽度 1μs，信号周期 4μs 的脉冲序列占空比为 0.25；②在一段连续工作时间内脉冲占用的时间与总时间的比值；③在周期型的现象中，现象发生的时间与总时间的比；④占空比是高电平所占周期时间与整个周期时间的比值。

(3) stray (寄生)。寄生的含义就是本来没有在那个地方设计电容，但由于布线构之间总是有互感，互感就好像是寄生在布线之间的一样，所以叫寄生电容。

寄生电容一般是指电感、电阻、芯片引脚等在高频情况下表现出来的电容特性。实际上，一个电阻等效于一个电容、一个电感和一个电阻的串联，在低频情况下表现不是很明显，而在高频情况下，等效值会增大，且不能忽略。在计算中人们要考虑进去。ESL 就是等效电感，ESR 就是等效电阻。不管是电阻、电容、电感，还是二极管、三极管、MOS 管，还有 IC，在高频的情况下人们都要考虑到它们的等效电容值、电感值。

(4) Digital (数字)。数字这个术语源自计算机通过计数完成一些操作的方式。多年以来，数字电子学的应用仅限于计算机系统。今天，数字技术已在计算机以外的许多领域得到应用。例如，电视、通信系统、雷达、航空及导航系统、军事系统、医疗仪器、工业过程控制及日用品电子学等都会用到数字技术。数字技术的发展从真空管电路到分立式晶体管，再到含有几百万个晶体管的复杂集成电路。

(5) In practice, it is common to measure rise time from 10% of the pulse amplitude (height from baseline) to 90% of the pulse amplitude and to measure the fall time from 90% to 10% of the pulse amplitude, as indicated in Fig. 4.2. 此长句中包含一个基本的句型：It is (was) + a. + (for sb.) + to do sth. 只要理解掌握了该句型，这个长句就变得很简单了。

Word-Study

Happen, Occur, Take place

Notes:

(1) **Happen** is the usual word that you use to refer to events that are not planned or expected.

(2) **Occur** meaning "happen" is used only in formal situations.

(3) **Take place** is also quite formal and is usually used to talk about an event that has been planned or arranged or when people take an active part in sth.

(1) You look terrible, what's happened?

(2) What happened when you told him the news?

(3) Police report that the accident occur at about 9:30p.m..

(4) The festival takes place in July every year. (= The festival is in July every year.)

(5) Filming took place in Ireland. (= The movie was filmed in Ireland)

Sentence Patterns

It + be + a./n.+ the infinitive

It + takes/makes/pay/costs…+ the infinitive

It + delighted/annoyed/excited/amused… + the infinitive

It + be + predictive + doing sth

It + no use/good/fun… + doing sth

(1) It is important { to know about } the feature of plus.
(2) It is not right { to speak } ill of someone behind his back.

(3) It is not an easy thing { to master } a foreign language.
(4) It takes ten years { to finish } my specialized book on electronics.

(5) It pays { to be } honest.
(6) It feels good { to stay } away from the crowded city.

(7) It annoyed her { to see } someone spit on the ground.
(8) It amused me { to have a } funny talking with him.

(9) It is no good { smoking } a lot of cigarettes.
(10) It is no use { crying } over spilt milk.

Exercises

Ⅰ.Translate the following sentences.

1. Digital waveforms consist of voltage levels that are changing back and forth between the HIGH and LOW levels or states.

2. In practice, these transitions never occur instantaneously, although for most digital work you can assume ideal pulses.

3. The overshoot and ringing are sometimes produced by stray inductive and capacitive effects.

4. The time required for a pulse to go from its LOW level to its HIGH level is called the rise time and the time required for the transition from the HIGH level to the LOW level is called the fall time.

5. Waveform Characteristics: Most waveforms encountered in digital systems are composed of a series of pulses, sometimes called pulse trains, and can be classified as either periodic or nonperiodic.

Ⅱ. Choose an appropriate translation from Column B for each of the words in Column A.

		Column A		Column B
( )	1.	pulse	A.	鸣震，震荡
( )	2.	positive-going	B.	假定的，假设的，设想的
( )	3.	transition	C.	产生，生成
( )	4.	generate	D.	超调；超过
( )	5.	assumed	E.	脉冲串
( )	6.	instantaneously	F.	正向的
( )	7.	negative-going	G.	电阻；抵抗，反抗，抵抗能力
( )	8.	resistance	H.	即刻地；突如其来地
( )	9.	ringing	I.	负向的
( )	10.	duty cycle	J.	常数，常量；不变的事物
( )	11.	droop	K.	脉冲；脉搏；(心的)一次跳动
( )	12.	overshoot	L.	占空比[序列脉冲信号的保持时间与其周期比]
( )	13.	constant	M.	杂散，寄生；走失，离群，迷路

( ) 14. pulse trains N. 过渡(过程)，转变，迁移，转换

( ) 15. stray O. 固定偏差

Ⅲ. Fill in the blanks with the words given below . Change the form when necessary.

generate	assumed	resistance	periodic	randomly	ratio	pulse	amplitude

1. Copper has less_________to electricity than lead.
2. They were_________divided into different groups.
3. This new boiler_________more heat than the old one.
4. Long long ago, we knew the_________motion of a planet.
5. The_________of water to oil was 30 to 1.
6. It works by increasing_________of reproduced sound.
7. He was discovered living under an_________identity in South America.
8. This radar is operated by an electronic_________.

Ⅳ. Complete the following sentences with phrases and expressions given below.

A. consist of **B.** a series of **C.** because of **D.** be made up of **E.** be classified as

1. The result of experiment is uncertain_________uncontrollable circumstances.
2. Some of the methods might_________follows.
3. The atmosphere_________more than 70% of nitrogen(氮气)。
4. This equipment _________three different parts.
5. The post office will issue_________new stamps.

Reading 4: A Digital Waveform Carries Binary Information

Binary information that is handled by digital systems appears as waveforms that represent sequences of bits. When the waveform is HIGH, a binary 1 is present; when the waveform is LOW, a binary 0 is present. Each bit in a sequence occupies a defined time interval called a bit time.

The Clock in digital systems: all waveforms are synchronized with a basic timing waveform called the clock. The clock is a periodic waveform in which each interval between pulses (the period) equals the time for one bit.

An example of a clock waveform is shown in Fig. 4.4. Notice that, in this case, each change in level of waveform *A* occurs at the leading edge of the clock waveform. In other cases, level changes occur at the trailing edge of the clock. During each bit time of the clock, waveform *A* is either HIGH or LOW. These HIGHs and LOWs represent a sequence of bits as indicated. A group of several bits can be used as a piece of binary information, such as a number or a letter. The clock waveform itself does not carry information.

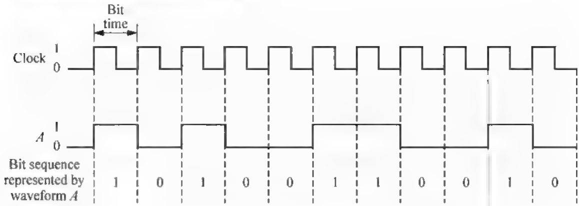


Fig. 4.4 Example of a clock waveform synchronized with a waveform representation of a sequence of bits

Timing Diagrams: A timing diagram is a graph of digital waveforms showing the actual time relationship of two or more waveforms and how each waveform changes in relation to the others. By looking at a timing diagram, you can determine the states (HIGH or LOW) of all the waveforms at any specified point in time and the exact time that a waveform changes state relative to the other waveforms. Fig. 4.5 is an example of a timing diagram made up of four waveforms. From this timing diagram you can see, for example, that the three waveforms A, B and C are HIGH only during bit time 7 and they all change back LOW at the end of bit time 7 (shaded area).

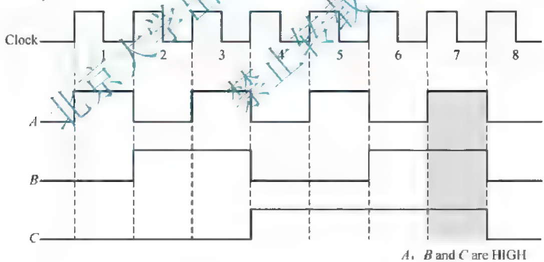
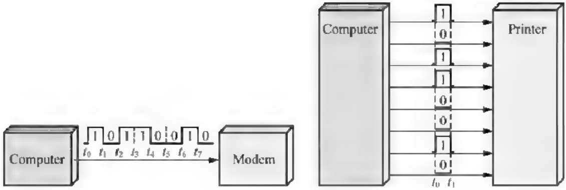


Fig. 4.5 Example of a timing diagram

Data Transfer: Data refers to groups of bits that convey some type of information. Binary data, which are represented by digital waveforms, must be transferred from one circuit to another within a digital system or from one system to another in order to accomplish a given purpose. For example, numbers stored in binary form in the memory of a computer must be transferred to the computer's central processing unit in order to be added. Then the sum of the addition must be transferred to a monitor for display and/or transferred back to the memory. In computer systems, as illustrated in Fig. 4.6, binary data are transferred in two ways: serial and parallel.



(a) Serial transfer of 8 bits of binary data from computer to modem. Interval t_0 to t_1 is first

(b) Parallel transfer of 8 bits of binary data from computer to printer. The beginning time is t_0

Fig. 4.6 Illustration of serial and parallel transfer of binary data (Only the data lines are shown)

When bits are transferred in serial form from one point to another, they are sent one bit at a time along a single line, as illustrated in Fig. 4.6(a), for the case of a computer-to-modem transfer. During the time interval from t_0 to t_1, the first bit is transferred. During the time interval from t_1 to t_2, the second bit is transferred, and so on. To transfer eight bits in series, it takes eight time intervals.

When bits are transferred in parallel form, all the bits in a group are sent out on separate lines at the same time. There is one line for each bit, as shown in Fig. 4.6(b), for the example of eight bits being transferred from a computer to a printer. To transfer eight bits in parallel, it only takes one time interval compared to eight time intervals for the serial transfer.

To summarize, the advantage of serial transfer of binary data is that a minimum of only one line is required. In parallel transfer, a number of lines equal to the number of bits to be transferred at one time is required. The disadvantage of serial transfer is that it takes longer to transfer a given number of bits than with parallel transfer. For example, if one bit can be transferred in 1μs, then it takes 8 μs to serially transfer eight bits, but only 1 μs to parallel transfer eight bits. The disadvantage of parallel transfer is that it takes more lines than serial transfer[4].

Unit 5

Text 5: Basic Logic Operations

In its basic form, logic is the realm of human reasoning that tells you a certain proposition (declarative statement) is true if certain conditions are true. Propositions can be classified as true or false. Many static situations and dynamic processes that you encounter in your daily life can be expressed in the form of prepositional or logic functions. Since such functions are true/false or yes/no statements, digital circuits with their two-state characteristics are applicable.

Several propositions, when combined, can form propositional or logic, functions. For example, the propositional statement "The light is on" will be true if "The bulb is not burned out" is true and if "The switch is on" is true. Therefore, this logical statement can be made: The light is on only if the bulb is not burned out and the switch is on. In this example the first statement is true only if the last two statements are true. The first statement ("The light is on") is then the basic proposition and the other two statements are the conditions on which the proposition depends.

In the 1850s, the Irish logician and mathematician George Boole developed a mathematical system for formulating logic statements with symbols, so that problems can be written and solved in a manner similar to ordinary algebra. Boolean algebra, as it is known today, is applied in the design and analysis of digital systems .

The term logic is applied to digital circuits used to implement logic functions. Several kinds of digital logic circuits are the basic elements that form the building blocks for such complex digital systems as the computer. We will now look at these elements and discuss their functions in a very general way. Later chapters will cover these circuits in detail.

Three basic logic operations (NOT, AND, and OR) are indicated by standard distinctive shape symbols in Figure 5.1. The lines connected to each symbol are the inputs and outputs. The inputs are on the left of each symbol and the output is on the right. A circuit that performs a specified logic operation (AND, OR) is called a logic gate. AND and OR gates can have any number of inputs, as indicated by the dashes in Fig. 5.1.

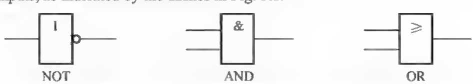


Fig.5.1 The basic logic operations and symbols

In logic operations, the true/false conditions mentioned earlier are represented by a HIGH (true) and a LOW (false). Each of the three basic logic operations produces a unique response to a given set of conditions.

NOT: The NOT operation changes one logic level to the opposite logic level, as indicated in Figure 5.2. When the input is HIGH (1), the output is LOW (0). When the input is LOW, the output is HIGH. In either case, the output is not the same as the input. The NOT operation is implemented by a logic circuit known as an inverter.

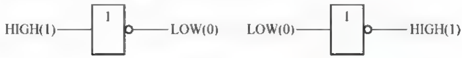


Fig. 5.2 The NOT operation

AND: The AND operation produces a HIGH output only when all the inputs are HIGH, as indicated in Figure 5.3 for the case of two inputs. When one input is HIGH and the other input is HIGH, the output is HIGH. When any or all inputs are LOW, the output is LOW. The AND operation is implemented by a logic circuit known as an AND gate.

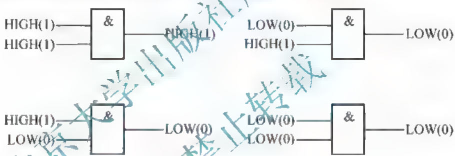


Fig. 5.3 The AND operation

OR: The OR operation produces a HIGH output when one or more inputs are HIGH, as indicated in Figure 5.4 for the case of two inputs. When one input is HIGH or the other input is HIGH or both inputs are HIGH, the output is HIGH. When both inputs are LOW, the output is LOW. The OR operation is implemented by a logic circuit known as an OR gate[4].

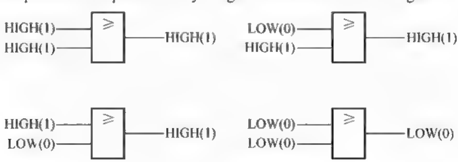


Fig. 5.4 The OR operation

Words and Expressions

1.	logic	['lɔdʒik]	*n.*	①逻辑(学) ②逻辑系统
2.	realm	[relm]	*n.*	区域，范围，领域
3.	proposition	[prɔpə'ziʃən]	*n.*	①命题 ②论点 ③建议
4.	declarative	[di'klærətiv]	*a.*	宣言的，公布的
5.	classify	['klæsifai]	*vt.*	界定；划分；分类
6.	encounter	[in'kauntə]	*vt.*	遇到，遭遇
7.	characteristic	[kæriktə'ristik]	*n.*	特性，特征
			a.	特有的，独特的
8.	applicable	['æplikəbl]	*a.*	适当的；合适的
9.	combine	[kəm'bain]	*vt.& vi.*	(使)联合，结合，混合
10.	bulb	[bʌlb]	*n.*	电灯泡
11.	logician	[ləu'dʒiʃən]	*n.*	逻辑学家
12.	mathematician	[mæθimə'tiʃən]	*n.*	数学家
13.	mathematical	[mæθə'mætikəl]	*a.*	①数学的 ②精确的
14.	formulate	['fɔ:mjuleit]	*vt.*	①构想出 ②确切地阐述
15.	algebra	['ældʒibrə]	*n.*	代数学，代数
16.	analysis	[ə'næləsis]	*n.*	解析，分析
17.	implement	['implimənt]	*vt.*	①实现，完成 ②填充
18.	complex	['kɔmpleks]	*a.*	复杂的，难懂的
19.	distinctive	[di'stiŋktiv]	*a.*	有特色的，与众不同的
20.	specified	['spesifaid]	*a.*	精确的；规定的
21.	dash	[dæʃ]	*n.*	破折号
22.	response	[ri'spɔns]	*n.*	①回答 ②反应，响应
23.	inverter	[in'və:tə]	*n.*	反用换流器；变频器
24.	burn out			烧掉，耗尽，筋疲力尽
25.	be applied to			适用于

Notes

(1) In its basic form, logic is the realm of human reasoning that tells you a certain proposition (declarative statement) is true if certain conditions are true.

句中 that 引导定语从句，其先行词是 the realm of human reasoning，关系代词 that 在从句中作主语。

(2) Many static situations and dynamic processes that you encounter in your daily life can be expressed in the form of prepositional or logic functions.

句中 that 引导定语从句，其先行词是 Many situations and processes，关系代词 that 在从句中作宾语。

(3) The first statement ("The light is on") is then the basic proposition and the other two statements are the conditions on which the proposition depends.

句中 which 引导定语从句，其先行词是 the conditions，关系代词 which 在从句中作宾语。

Word-Study

I. Announce, Declare, Proclaim, Pronounce, Advertise, Broadcast, Publish

(1) **Announce** means to officially tell people about a decision or something that will happen.

(2) **Declare** means to say officially and publicly that a particular situation exists or that something is true.

(3) **Proclaim** (formal) means to say publicly or officially that something important is true or exists.

(4) **Pronounce** means to make the sound of a letter, word etc., especially in the correct way.

Pronounce, formal, means to give a judgment or opinion in an official or legal situation.

(5) **Advertise** means to make a public announcement on television, in newspapers, or magazines etc. about something that is available or an event that is going to happen, to persuade people to buy or use it, go to the event, etc..

(6) **Broadcast** means to send out television or radio programs.

(7) **Publish** means to arrange for a book, magazine etc. to be written, printed, and sold.

They announced plans to close 11 factories.

A man's voice announced the departure of the L.A. bus.

Severe flooding prompted the governor to declare a state of emergency Tuesday.

Phillips has repeatedly proclaimed his innocence.

How do you pronounce your last name?

Leffert used the award ceremony to pronounce on the evils of drugs.

These companies advertise their products in magazines like Popular Electronics.

CBS will broadcast the championship game live.

We publish mainly textbooks and other educational materials.

II. Organize, Arrange, Classify, Sort

(1) **Organize** means to make the necessary arrangements so that an activity can happen.

(2) **Arrange** means to put a group of things or people in a particular order or position.

(3) **Classify** means to arrange things in a particular way, so that people can have a clear structure which is easy to use or understand.

(4) **Sort** means to arrange things in groups or in a particular order according to their type, etc.; to separate things of one type from others

I agreed to help organize the company picnic.

A key skill is the ability to organize information effectively.

We spent the morning arranging the jewelry in the display case.

Whales are classified as mammals rather than fish.

The computer sorts the words into alphabetical order.

Sentence Patterns

Adverbial clause of time

when, while, as	(1) When she came in, I stopped eating. (2) When I lived in the countryside, I used to carry some water for him. (3) We were about to leave when he came in. (4) While my wife was reading the newspaper, I was watching TV. (5) I like playing football while you like playing basketball. (6) We always sing as we walk. (7) As we was going out, it began to snow.
before, after	(1) It will be four days before they come back. (2) Einstein almost knocked me down before he saw me. (3) My father had left for Canada just before the letter arrived. (4) They had not been married four months before they were divorced. (5) After you think it over, please let me know what you decide. (6) After we had finished the work, we went home.
till, until	(1) I didn't go to bed until(till)my father came back. (2) I worked until he came back. (3) I didn't work until he came back.。 (4) Please wait until I arrived.
since	(1) I have been in Beijing since you left. (2) Where have you been since I last saw you? (3) It is four years since my sister lived in Beijing. (4) It is five months since our boss was in Beijing.

续表

as soon as, immediately, directly, instantly, the moment, the instant, the minute, etc.	(1) I will go there directly I have finished my breakfast. (2) The moment I heard the news, I hastened to the spot. (3) As soon as I reach Canada, I will ring you up.
hardly (scarcely, rarely)… when / before, no sooner… than	(1) He had no sooner arrived home than he was asked to start on another journey. (2) No sooner had the sun shown itself above the horizon than he got out of bed to commence work. (3) Hardly had I sat down when he stepped in. (4) He had hardly fallen asleep when he felt a soft touch on his shoulder.
by the time	(1) By the time you came back, I had finished this book. (2) By the time you come here tomorrow, I will have finished this work.
each time, every time, whenever	(1) Each time he came to Harbin, he would call on me. (2) Whenever that man says "To tell the truth", I suspect that he's about to tell a lie. (3) You grow younger every time I see you.
as long as, so long as	(1) You can go where you like as long as you get back before dark. (2) I will fight against these conditions as long as there is a breath in my body!

Exercises

Ⅰ. Answer the following questions with the information from the passage.

1. How many propositions can be classified?

2. Who developed a mathematical system for formulating logic statements with symbols in the 1850s?

3. What is applied in the design and analysis of digital systems?

4. What are the lines connected to each symbol?

5. Where are the inputs and the outputs?

6. What is the NOT operation implemented by?

7. When does the OR operation produce a HIGH output?

Ⅱ. Complete the following sentences with phrases and expressions given below.

A. be classified as **B.** burn out **C.** depend on **D.** be applied to **E.** the same as

1. Any electric light bulb will eventually _________.

2. All living things _________ the sun for their growth.

3. Containing unlike elements. In computer usage, the term may _________ a system or network using computers of different type or manufacturer.

4. Double- clicking a control- menu box is _________ choose the close command.

5. He would _________ rich by the standard.

III. Fill in the blanks with the words given below. Change the form when necessary.

logic	declarative	characteristic	applicable	response	distinctive

1. In this way they can better __________ theory to practice.
2. Your work is __________ by lack of attention to details.
3. We should make a __________ between right and wrong.
4. He __________ that the meeting has been postponed.
5. A __________ sub-division of a data base that contains all occurrences of stipulated data aggregates.
6. She has received a __________ from that college to her application.

IV. Choose an appropriate translation from Column B for each of the words in Column A.

		Column A		Column B
( )	1.	true propositions	A.	假命题
( )	2.	digital systems	B.	与门
( )	3.	logic operations	C.	非运算
( )	4.	false propositions	D.	数字系统
( )	5.	logic gates	E.	或门
( )	6.	AND gates	F.	逻辑运算
( )	7.	OR gates	G.	真命题
( )	8.	the NOT operation	H.	逻辑门

Reading 5: The Nyquist Criterion: Relating Bandwidth to Symbol Rate

Typically, a linearly modulated system is designed so as to avoid intersymbol interference at the receiver, assuming an ideal channel, as illustrated in Figure 5.5, which shows symbols going through a transmit filter, a channel (also modeled as a filter) and a receive filter (noise is ignored for now). Since symbols are being fed into the transmit filter at rate $1/T$, it is natural to expect that we can process the received signal such that, in the absence of channel distortions and noise, samples at rate $1/T$ equal the transmitted symbols. This expectation is fulfilled when the cascade of the transmit filter, the channel filter and the receive filter satisfy the Nyquist criterion for ISI avoidance, which we now state.

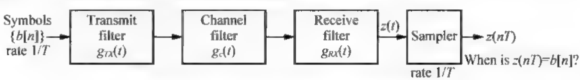


Fig. 5.5 Set-up for applying Nyquist criterion

In Fig. 5.5, the noiseless signal at the output of the receive filter is given by

$$z(t)=\sum_{n} b[n]x(t-nT) \tag{5.1}$$

where

$$x(t)=(g_{TX} \bullet g_{C} \bullet g_{RX})(t) \tag{5.2}$$

it is the overall system response to a single symbol. The Nyquist criterion answers the following question: when is $z(nT)=b[n]$? In other words, when is there no **ISI** in the symbol-spaced samples? The answer is stated in the following theorem.

Theorem (Nyquist criterion for ISI avoidance) Intersymbol interference can be avoided in the symbol-spaced samples, i.e.,

$$z(nT)=b[n] \qquad \text{for all n} \tag{5.3}$$

if

$$x(mT)=\delta_{m0}=\begin{cases}1, & m=0\\ 0, & m\neq 0\end{cases} \tag{5.4}$$

Letting $X(f)$ denote the Fourier transform of $x(t)$, the preceding condition can be equivalently written as

$$\frac{1}{T}\sum_{k=-\infty}^{\infty} X(f\pm\frac{k}{T})=1 \qquad \text{for all } f \tag{5.5}$$

Proof of Theorem: It is immediately obvious that the time domain condition (5.4) gives the desired ISI avoidance to (5.3). It can be shown that this is equivalent to the frequency domain condition (5.5) by demonstrating that the sequence $\{x(-mT)\}$ is the Fourier series for the periodic waveform $B(f)$.

$B(f)$ obtained by summing all the aliased copies $X(f+k/T)$ of the Fourier transform of $x(t)$.

$$B(f)=\frac{1}{T}\sum_{K=-\infty}^{\infty} x(f+\frac{k}{T}) \tag{5.6}$$

Thus, for the sequence $\{x(mT)\}$ to be a discrete delta, the periodic function $B(f)$ must be a constant..

A pulse $x(t)$ or $X(f)$ is said to be Nyquist at rate 1/T if it satisfies (5.4) or (5.5), where we permit the right-hand sides to be scaled by arbitrary constants.

Minimum bandwidth Nyquist pulse: The minimum bandwidth Nyquist pulse is

$$X(f)=\begin{cases}T, & |f|\leqslant \dfrac{1}{2T}\\ 0, & \text{else}\end{cases} \tag{5.7}$$

corresponding to the time domain pulse[5]

$$x(t)=\operatorname{sin}c\left(\frac{t}{T}\right) \tag{5.8}$$

Unit 6

Text 6: Review of Four Basic Analog Filter Approximations

Many types of analog filters can be built. Any one could be a low pass, highpass, bandpass, or a stopband filter. However, according to the nature of electrical circuits used to build analog filters, any of these filter types can be divided into four basic analog approximations that meet the graphical specification. These approximations are based on where the gain curve has ripples or deviations from a smoothly varying curve. In the first approximation, called the Butterworth, there are no ripples in any passband or stopband. Thus the digital IIR filter has no ripples in it either. The general gain curve is given in Fig. 6.1 for a lowpass filter specification. Similar graphical specifications could be drawn for highpass, bandpass or bandstop filters. Notice that in Fig. 6.1 the important characteristic is that the gain curve smoothly varies in the passband and the stopband up to half the sampling frequency.

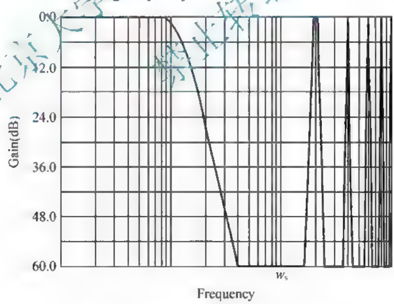


Fig. 6.1 Butterworth lowpass IIR filter

The second analog filter approximation to an ideal analog graphical filter specification is the Chebyshev, which has ripples in the passbands, but it has a smoothly decreasing gain curve in the stopbands. In Fig. 6.2 a lowpass IIR filter is used to illustrate a Chebyshev approximation. Similar gain curves could be drawn for a highpass, bandpass or bandstop filter. Notice that in Fig. 6.2

the gain curve has ripple in the passband, because the gain increases before it decreases. For higher-order filters the ripple is more obvious, with several cycles of increasing and decreasing gain in the passband. This is an unwanted deviation from the ideal analog filter. However, as the Chebyshev filter will have a narrower transition band between the stopbands and passbands, it trades off ripple in the passband for a gain curve that more closely approximates the ideal graphical filter specification by having a narrower transition band than the Butterworth filter.

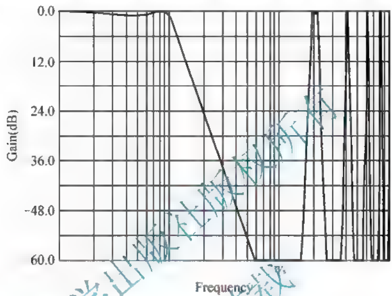


Fig. 6.2 Chebyshev lowpass IIR filter

The third analog filter approximation to the ideal analog graphical filter specification is the Inverse Chebyshev, which has no ripple in the passbands, but has ripple in the stopbands. In Fig. 6.3, an IIR bandpass filter is used to illustrate a digital approximation to an analog Inverse Chebyshev bandpass filter. Again, the ripples are an unwanted deviation from the ideal analog graphical filter specifications, but like the Chebyshev approximation it has a narrower transition band than the Butterworth. Many times this ripple in the stopbands is insignificant if the peaks of the ripples are under the stopband gain specification. This is in contrast to the Chebyshev filter, where the ripple in the passband is a deviation from the desired gain curve.

The fourth type of analog filter approximation to the ideal analog graphical filter specifications is the Cauer, which has ripple in the passbands and the stopbands. The reason this ripple is accepted is that the Cauer filter could have narrower transition bands than any of the other three approximations. Fig. 6.4 illustrates the digital IIR graphical specification for a bandstop filter. Notice that the ripple is both in the stopband and the passbands. If a highly selective filter is desired and some ripple in the gain curve is acceptable, then the Cauer filter is the best choice[6].

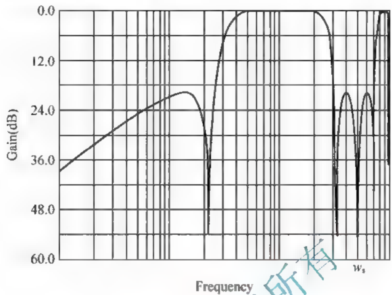


Fig. 6.3 Inverse Chebyshev bandpass IIR filter

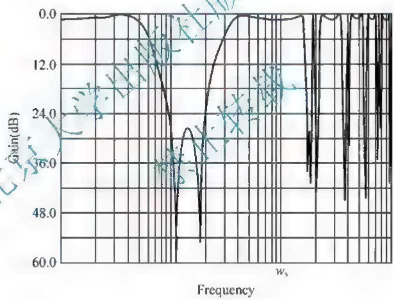


Fig. 6.4 Cauer bandstop IIR filter

Words and Expressions

1.	passband	['pɑ:sbænd]	*n.*	通频带
2.	stopband	['stɔpbænd]	*n.*	阻带，抑止带
3.	approximation	[əprɔksi'meiʃən]	*n.*	①接近 ②近似额；概算 ③[数]近似值

4.	ripple	['ripl]	*n.*	波纹
5.	cycle	['saikl]	*n.*	周期，循环
6.	graphical	['græfikəl]	*a.*	图形的，图像的，图示的
7.	transition	[træn'ziʃən]	*n.*	过渡，转变，转换
8.	insignificant	[insig'nifikənt]	*a.*	可忽略的；无关紧要的
9.	analog filter			模拟滤波器
10.	lowpass filter			低通滤波器
11.	highpass filter			高通滤波器
12.	electrical circuit			电路
13.	gain curve			增益曲线
14.	Butterworth			巴特沃斯
15.	Chebyshev			切比雪夫
16.	Inverse Chebyshev			逆切比雪夫(逼近)
17.	Cauer			考尔
18.	trade off			权衡，折中，取舍

Notes

(1) lowpass filter (低通滤波器)。低通滤波器是容许低于截至频率的信号通过，但高于截止频率的信号不能通过的电子滤波装置。

(2) Butterworth filter (巴特沃斯滤波器)。巴特沃斯滤波器是滤波器的一种设计分类，其采用的是巴特沃斯传递函数，有高通、低通、带通、带阻等多种滤波器类型。巴特沃斯滤波器在通频带内外都有平稳的幅频特性，但其有较长的过渡带，在过渡带上很容易造成失真。

(3) Chebyshev filter (切比雪夫滤波器)。切比雪夫滤波器也是滤波器的一种设计分类，其采用的是切比雪夫传递函数，也有高通、低通、带通、带阻等多种滤波器类型。同巴特沃斯滤波器相比，切比雪夫滤波器的过渡带很窄，但其内部的幅频特性却很不稳定。

(4) 低通滤波器有很多种，其中最通用的就是巴特沃斯滤波器和切比雪夫滤波器。

Word-Study

Electric, electrical, electricity, electronic

Notes: **Electric** is usually used to describe something that uses or produces electricity. You

use **electrical** with more general nouns such as equipment and airing and things that are concerned with **electricity**.

(1) This heavy freighter is driven by two electric motors.

(2) I feel an electric current through my hand when I touch the wire.

(3) The cooker isn't working because of an electrical fault.

(4) There are a lot of electrical equipments in our lab.

Sentence Patterns

be used as

be used to do

be used to sth. / doing sth.

used to do sth

come into use

make use of

(1) An adaptive filter is being used as communication in coal mine underground.

(2) This method was used to research the surface flexible reconstruction based on approximation in reverse engineering (基于逼近理论的逆向工程曲面柔性重构技术研究).

(3) I am used to this software of the spreadsheet application.

(4) How long have you been used to mastering the word processing?

(5) When did the Chebyshev filter come in to common use?

(6) Wood can be used to make paper.

(7) We should make better use of our resourses.

Exercises

Ⅰ. Answer the following questions with the information from the passage.

1. How many filter types can be divided into? And why?
2. What's the function of the lowpass IIR filter in Fig. 6.2?
3. What's the function of the IIR bandpass filter in Fig. 6.3?
4. Why the ripple in the passbands of the Cauer is accepted?
5. Try to describe the four basic analog filer approximations in your own words.

Ⅱ. Choose an appropriate translation from Column B for each of the words in Column A.

		Column A		Column B
( )	1.	analog filter	A.	电路
( )	2.	electrical circuit	B.	切比雪夫
( )	3.	Butterworth	C.	考尔
( )	4.	gain curve	D.	模拟滤波器
( )	5.	Cauer	E.	增益曲线
( )	6.	Chebyshev	F.	巴特沃斯

Ⅲ. Fill in the blanks with the words given below. Change the form when necessary.

approximation	ripple	deviation	transition	insignificant

1. A network of _________ quivered momentarily across the surface of the still pool.
2. Adolescence is the period of _________ between childhood and adulthood.
3. The rate has fallen by an _________ amount.
4. We do not have the true figures so we will have to make some _________.
5. Any _________ from the party's faith is seen as betrayal.

Reading 6: Summary of Memory Byte Pools

A memory byte pool is similar to a standard C heap. In contrast to the C heap, a ThreadX application may use multiple memory byte pools. In addition, threads can suspend on a memory byte pool until the requested memory becomes available.

Allocations from memory byte pools resemble traditional malloc calls, which include the amount of memory desired (in bytes). ThreadX allocates memory from the memory byte pool in a first-fit manner, i.e., it uses the first free memory block that is large enough to satisfy the request. ThreadX converts excess memory from this block into a new block and places it back in the free memory list. This process is called fragmentation.

When ThreadX performs a subsequent allocation search for a large-enough block of free memory, it merges adjacent free memory blocks together. This process is called defragmentation.

Each memory byte pool is a public resource. ThreadX imposes no constraints on how memory byte pools may be used. Applications may create memory byte pools either during initialization or during run-time. There are no explicit limits on the number of memory byte pools an application may use, too.

The number of allocatable bytes in a memory byte pool is slightly less than what was specified during creation. This is because management of the free memory area introduces some overhead. Each free memory block in the pool requires the equivalent of two C pointers of

overhead. In addition, when the pool is created, ThreadX automatically divides it into two blocks, a large free block and a small permanently allocated block at the end of the memory area. This allocated end block is used to improve performance of the allocation algorithm. It eliminates the need to continuously check for the end of the pool area during merging. During run-time, the amount of overhead in the pool typically increases. This is partly because when an odd number of bytes is allocated, ThreadX pads out the block to ensure proper alignment of the next memory block. In addition, overhead increases as the pool becomes more fragmented.

The memory area for a memory byte pool is specified during creation. Like other memory areas, it can be located anywhere in the target's address space. This is an important feature, because of the considerable flexibility it gives the application. For example, if the target hardware has a high-speed memory area and a low-speed memory area, the user can manage memory allocation for both areas by creating a pool in each of them.

Application threads can suspend while waiting for memory bytes from a pool. When sufficient contiguous memory becomes available, the suspended threads receive their requested memory and are resumed. If multiple threads have suspended on the same memory byte pool, ThreadX gives them memory and resumes them in the order they occur on the Suspended Thread List (usually FIFO). However, an application can cause priority resumption of suspended threads, by calling tx_byte_pool_prioritize prior to the byte release call that lifts thread suspension. The byte pool prioritize service places the highest priority thread at the front of the suspension list, while leaving all other suspended threads in the same FIFO order[7].

Unit 7

Text 7: The Growth of Bandwidth and the Digital Revolution

Electrical telecommunication started with a single wire with a ground return, but as the system grew, the common ground return had to be replaced with a return wire, hence the advent of the open-wire telephone line. The open-wire system with its forests of telegraph poles along city streets which strung with an endless array of wires eventually gave way to the twisted pair cable. The twisted pair cable owes its existence to improved insulating materials, especialty plastics, which reduced the space requirements of the cable. The bandwidth of an unloaded twisted pair is approximately 4 kHz and it decreases rapidly with length. This can be improved by connecting inductors (loading coils) in series with the line at specific distances and by various equalization schemes to about 1MHz. However, the twisted pair has found a niche in the modern telephone system where its bandwidth approximately matches that required for analog audio communication. This is still the dominant mode of telephone communication up to the central office. Beyond the central office the network of inter-office trunks use a variety of conduits for the transmission of the signal.

Increased bandwidth alone was not an answer to the expanding telecommunication traffic. High-frequency carriers had to be developed in order to fully exploit the bandwidth capability of new telecommunication media such as coaxial cables, terrestrial microwave networks and fiber optics. The development of the coaxial cable, which confines the electromagnetic wave to the annular space between the two concentric conductors, reduced significantly the radiation losses that would otherwise occur. As a result the bandwidth was increased to approximately 1GHz and attenuation was reduced. Terrestrial as well as satellite microwave communication systems have further expanded the bandwidth into the terahertz range, for those who can afford the dish antenna and its associated equipment, it has increased the number of television channels available to over 800. The application of fiber optics to telecommunication has extended the channel bandwidth to that of visible light (1×10^{12}Hz). It is now possible for one optical fiber to carry as many as 300×10^{9} telephone channels at the same time.

An increasingly dominant factor in telecommunication is the enormous popularity of digital techniques. The information is reduced to a train of pulses (binary digits, 1 and 0) and sent over

the channel. The limited bandwidth, phase change and the noise in the channel cause the signal to deteriorate, so it is necessary to refresh or regenerate the signal at various points along the channel. This is accomplished by using repeaters whose function is to determine whether the digit that be sent was a 1 or a 0 and to generate the appropriate new digits and transmit them. At the receiving end, the digits are converted back into an analog signal. The compact disc music recording system is a common example of this technique. The need for information transfer between computers spurred on the development of digital communication, speech signals are increasingly being converted into digital form for telephone transmission[8].

Words and Expressions

1.	electrical	[i'lektrikəl]	*a.*	①与电有关的 ②电学的，电的
2.	telecommunication	[ˌtelikəˌmju:ni'ʃən]	*n.*	①远程通信 ②电信
3.	advent	['ædvənt]	*n.*	①出现；到来 ②将临期；基督降临(圣诞节前的 4 个星期)
4.	array	[ə'rei]	*n.*	①数组，阵列 ②展示，陈列 ③排列；大堆，大量
5.	cable	['keibl]	*n.*	①[电工学]电缆，多芯导线，被覆线 ②[航海学]锚索，锚链
6.	insulating	['insjuleitiŋ]	*a.*	绝缘的
7.	inductor	[in'dʌktə]	*n.*	电感(器)
8.	equalization	[i:kwəlai'zeiʃən]	*n.*	均衡
9.	niche	[nitʃ]	*n.*	①合适的位置(工作等) ②(产品的)商机，市场定位 ③生态位(一个生物所占据的生境的最小单位)
10.	analog	['ænəlɔ:g]	*n.*	模拟，模拟物
11.	audio	['ɔ:diəu]	*a.*	音频，音频的；听觉的；声音的
12.	dominant	['dɔminənt]	*a.*	①占优势的 ②统治的，支配的
13.	trunk	[trʌŋk]	*n.*	①信息通路，总线，干线 ②树干 ③衣箱 ④象鼻
14.	conduit	['kɔndit]	*n.*	①[电]管道；水管；导电管 ②中转人；中转机构；中转国
15.	transmission	[træns'miʃən]	*n.*	①传输，发送，传送 ②(电台或电视)信息，广播

16.	traffic	['træfik]	*n.*	①通信量；(又称)业务量，话务量 ②流动的车辆[行人]，交通 ③(非法的)交易，买卖
17.	terrestrial	[ti'restriəl]	*a.*	①陆地上的，地面上的 ②陆栖的；陆生的
18.	confine	[kən'fain]	*v.*	①限制 ②禁闭
19.	electromagnetic	[i'lektrəumæg'netik]	*a.*	电磁的
20.	annular	['ænjulə]	*a.*	①环形，圆环 ②有环纹(的)
21.	concentric	[kən'sentrik]	*a.*	同轴的，同心的
22.	radiation	[ˌreidi'eiʃən]	*n.*	辐射
23.	attenuation	[əˌtenju'eiʃən]	*n.*	衰减
24.	terahertz	['terəhə:tz]	*n.*	太(拉)赫(频率单位，等于百亿赫)
25.	visible	['vizəbl]	*a.*	①看得见的，可见的，有形的 ②明显的，可察觉到的
26.	popularity	[ˌpɔpju'læriti]	*n.*	普遍；流行
27.	deteriorate	[di'tiriəreit]	*v.*	恶化；变坏；退化
28.	refresh	[ri'freʃ]	*v.*	①刷新，更新 ②使恢复；使振作 ③使……记起
29.	Repeaters	[ri'pi:təs]	*n.*	中继器
30.	convert	[kən'və:t]	*v.*	转变，转换
31.	transfer	[træns'fə:]	*v.*	①转让；让渡 ②(使)调动；转职；转学；转车 ③转会(尤指职业足球队) ④转存，转录(资料、音乐等)；改编
32.	ground return			地回路
33.	return wire			回流线
34.	twisted pair			双绞线
35.	owe… to			①把……归功于；应该感谢 ②欠……(某物)
36.	in series			串联地；连续地
37.	coaxial cable			同轴电缆
38.	fiber optics			光导纤维
39.	dish antenna			[计]碟形天线，抛物面天线
40.	binary digits			二进制的数字

Notes

(1) 本章简要介绍了带宽和通信形式的发展过程以及数字信号是如何传送的。

(2) 带宽(Bandwidth)。带宽又称频宽，它是指在固定的时间可传输的资料数量，亦即在传输管道中可以传递数据的能力。在数字设备中，频宽通常以 bps 表示，即每秒可传输的位数。在模拟设备中，频宽通常以每秒传送周期或赫兹 Hertz (Hz)来表示。频宽对于基本输入输出系统(BIOS)设备尤其重要。

(3) 本文虽篇幅不长，但文中出现的长句较多。阅读时要注意分词与词之间、句与句之间的关系，正确分析句子结构是准确理解句意的前提。这也是本文语法的重点、难点。

(4) Terrestrial as well as satellite microwave communication systems have further expanded the bandwidth into the terahertz range, for those who can afford the dish antenna and its associated equipment, it has increased the number of television channels available to over 800.

该句很长，不易理解。因此一定要从分析句子结构入手，从整体上把握。首先可以把逗号里面的成分提出来，先不去翻译它，然后把剩下的部分连起来。这样，句子看起来就清晰多了。最后，再把逗号里面的句子加进去。全句译为：同卫星微波通信系统一样，地面通信也进一步将带宽扩大到兆赫级别，从而使那些能够买得起碟形天线和相关设备的人可以收看 800 多个电视频道。

Word-Study

Ability, Capacity, Capability

(1) have the ability to do sth

(2) have the capacity { to do sth. / for doing sth. }

(3) have the capability { to do sth. / of doing sth. }

(1) The system has the ability to run more than one program at the same time.

(2) College students in 21st century should have the capacity of understanding and learning languages.

(3) Limited resources are restricting our capacity for developing new products.

(4) He has a great capacity to understand languages.

(5) The plan is beyond/within the capabilities of current technology.

(6) The increase bandwidth alone has not the capability to expand the telecommunication traffic.

Sentence Patterns

Although, Though, However and Even Though

Notes:

(1) You can use these words (phrase) to show contrast between two clauses or two sentences. **Though** is used more in spoken English than in written. You can use **although**, **even though** and **though** at the beginning of a sentence or clause that has verb.

(2) You can not use **even** on its own at the beginning of a sentence or a clause instead of **although**, **even though** or **though**.

(3) **Although** and **though** can also mean "but", like **however**, which is more formal. They cannot go in the same place in a sentence. Notice where the commas go.

(4) Note that you cannot use **however** in a sentence that begins with **although**, **though** or **even though**.

Although Even though Though	the bandwidth meets the current criterion,	we improve it.
The bandwidth doesn't meet the current criterion	although even though though	we improve it.
We improve the bandwidth.	However,	it meets the current criterion.
	it meets the current criterion,	however. though.

Exercises

Ⅰ. Fill in the following blanks according to the text.

1. Electrical telecommunication started with a single wire with ________, but as the system grew, the common ground return had to be replaced with ________, hence the advent of the open-wire telephone line.

2. The information is reduced to a train of pulses (binary digits, 1 and 0) and sent over ________.

3. The bandwidth of an unloaded twisted pair is approximately ________ and it decreases rapidly with length.

4. High-frequency carriers had to be developed in order to fully exploit the bandwidth

capability of new telecommunication media such as ________, terrestrial microwave networks and ________.

5. However, the twisted pair has found a ________ in the modern telephone system where its bandwidth approximately matches that required for ________.

Ⅱ. Translate the following sentences into Chinese.

1. Increased bandwidth alone was not an answer to the expanding telecommunication traffic.

2. This can be improved by connecting inductors (loading coils) in series with the line at specific distances and by various equalization schemes to about 1MHz.

3. Terrestrial as well as satellite microwave communication systems have further expanded the bandwidth into the terahertz range, for those who can afford the dish antenna and its associated equipment, it has increased the number of television channels available to over 800.

4. The open-wire system with its forests of telegraph poles along city streets strung with an endless array of wires eventually gave way to the twisted pair cable.

5. The limited bandwidth, phase change and the noise in the channel cause the signal to deteriorate, so it is necessary to "refresh" or regenerate the signal at various points along the channel.

Ⅲ. Fill in the blanks with the words given below . Change the form when necessary.

electrical	telecommunication	inductor	analog	dominant
traffic	electromagnetic	radiation	visible	refresh

1. The British were formerly _______ in India.
2. This glass of iced tea will _______ you.
3. He is an _______ engineer.
4. Relations between the two countries have _______ sharply in recent weeks.
5. This apparatus(仪器) produces harmful _______.
6. These tiny creatures are hardly _______ to the naked eyes.
7. Radio _______ has stepped up enormously.
8. Her hypothesis(假说)concerns the role of _______ radiation.
9. The street plan of the city has evolved as a series of _______ rings.
10. It's a very complicated process to convert from _______ to digital data.

Reading 7: The Transmission of Images

Shortly after the establishment of the telegraph, the transmission of images by electrical means was attempted by Giovanni Caselli (1815–1891) in France. His technique was to break up the picture into little pieces and send a coded signal for each piece over a telegraph line. The picture was then reconstituted at the receiving end. The system was slow, even for static images,

but it established the basic principles for image transmission; that is, the break up of the picture into some elemental form (scanning) the quantization of each element in terms of how bright it is (coding) and the need for some kind of synchronization between the transmitter and the receiver. Subsequent practical image transmission schemes, whether mechanical or electronic, had these basic units.

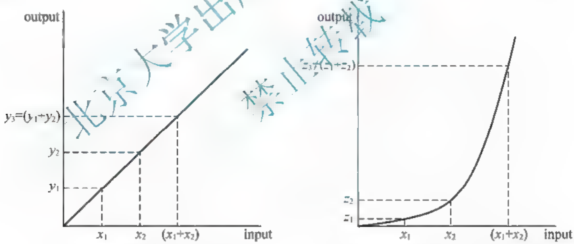
The discovery in 1873 by Joseph May, a telegraph operator at the Irish end of the transatlantic cable, that when a selenium resistor was exposed to sunlight its resistance decreased, led to the development of a light-to-current transducer. Subsequently, various schemes for image transmission based on this discovery were devised by George Carey, William Ayrton (1847–1908), John Perry and others. None of these was successful because they lacked an adequate scanning system and each element of the picture had to be sent on a separate circuit, making them quite impractical.

In 1884, Paul Nipkow (1860-1940) was granted a patent in Germany for what became known as the Nipkow Disc. This consisted of a series of holes drilled in the form of spirals in a disc. When an image is viewed through a second disc with similar holes driven in synchronism with the first, the observed effect was scanning point-to-point to form a complete line and line-by-line to cover the complete picture. This was a practical scheme since the point-to-point brightness of the picture could be transmitted and received serially on a single circuit. The persistence of an image on the human eye could be relied on to create the impression of a complete scene when, in fact, the information is presented point-by-point. Nipkow' s scheme could not be exploited until 1927 when photosensitive cells, photomultipliers, electron tube amplifiers and the cathode ray tube had been invented and had attained sufficient maturity to process the signals at an acceptable speed for television. Several people made significant contributions to the development of the components as well as to the system. However, two people, Charles Jenkins (1867–1934) and John Baird (1888–1946), are credited with the successful transmission of images at about the same time. They both used the Nipkow disc. Mechanical scanning methods of various forms were used with reasonable success until about 1930 when Vladimir Zworykin (1889–1982) invented the "iconoscope" and Philo Farnsworth (1906–1971) invented the electronic camera tube, which he called the "image dissector". These inventions finally removed all the moving parts from television scanning systems and replaced them with electronic scanning. The application of very-high-frequency carriers and the use of coaxial cables have contributed significantly to the quality of the pictures. The use of color in television had been shown to be feasible in 1930, but it did not be available to the general public until the mid-1960s. By the 1980s, satellite communication systems brought a large number of television programs to viewers who could afford the cost of the dish antenna. By the beginning of the 21st century, the dish antennas had shrunk in size from over 3m to less than 70 cm and the signal had changed into digital form[8].

Unit 8

Text 8: Superposition

The principle of superposition is a very simple and yet very powerful concept of great importance to electrical and electronic engineering. It is illustrated in Fig. 8.1 and perhaps best explained by the formal statement of the principle. The general form states is that: "If a linear system, which is initially at rest (no offset), is excited by two or more inputs the total output of the system is the sum of outputs obtained when each input is applied separately with all others setting to zero". In other words, if in a linear system an input x_1 results in an output y_1 and another input x_2 results in the output y_2, then the combined input $x_1 + x_2$ will result in the output $y_1 + y_2$. In an electrical circuit x and y will be voltages and/or currents as discussed below.



(a) Superposition in a linear circuit (b) Superposition in a non-linear circuit

Fig. 8.1 An illustration of the principle of superposition

The proof of the theorem is equally simple. Just consider the three triangles of Fig. 8.1(a) formed by $x_1 - y_1$, $x_2 - y_2$ and $x_1 + x_2 - (y_1 + y_2)$. They are similar (in the formal geometrical sense). Therefore

$$\frac{y_1}{x_1} = \frac{y_2}{x_2} = \frac{y_1 + y_2}{x_1 + x_2} \tag{8.1}$$

The corresponding triangles, in the case of non-linear circuits in Fig. 8.1(b), $x_i - z_i$, etc. are not similar and therefore the principle of superposition does not apply to them.

Superposition is important mainly for the following reasons.

(1) It allows for measurements and calculations to be made at one magnitude only. The results can be simply scaled to find all the required quantities at any other magnitude.

(2) It allows the simplification of the measurement and calculation of the output of a circuit which has more than one input signal applied to it at any one time. The output with all the signals applied at the same time is the sum of the outputs with each of the input signals applied one at a time.

(3) It also allows the results of measurements and calculations made with one type of waveform to provide information about the behaviour of the circuit with other waveforms. So, for example, results of measurements or calculations made with sine waves can be used to determine the output from a square wave input via the Fourier relationships. These relationships provide the link between the time and frequency domain considerations, the link between a waveform and its frequency spectrum. Using the most convenient way to describe the behaviour of circuits is extremely useful in virtually all fields of electronics.

The principle can also be stated in a form more specifically relevant to electrical circuit analysis as follows: "In a linear circuit containing several independent sources of voltage or current the voltage across and the current through a circuit element is the **algebraic sum** of the voltages or currents of that element produced by each of the sources acting alone".

Note that since $P = I^2R = V^2/R$ power is not linearly related to voltage or current, so the principle of superposition does not apply directly to calculations of power[9].

Words and Expressions

1.	analysis	[ə'næləsis]	*n.*	①分析；解析 ②要略；梗概；纲领
2.	behaviour	[bi'heivjə]	*n.*	①行为；举止；表现 ②表现方式；活动方式；态度
3.	calculation	[ˌkælkjə'leiʃən]	*n.*	①计算；计算结果 ②推断；预测；估计
4.	concept	['kɔnsept]	*n.*	①观念；概念；设想 ②总的印象；思维的产物；发明
5.	consideration	[kənˌsidə'reiʃən]	*n.*	①仔细考虑；深思；斟酌 ②考虑周到；体谅；顾及 ③报酬；补偿费
6.	convenient	[kən'vi:njənt]	*a.*	①方便的；便利的；合适的 ②实用的；省事的

7.	corresponding	[ˌkɔris'pɔndiŋ]	*a.*	①相当的；对应的；相应的；相关的 ②符合的；一致的
8.	domain	[do'men]	*n.*	①(知识、活动的)领域；范围；范畴 ②领土；领地；势力范围 ③地产；产业
9.	extremely	[iks'tri:mli]	*ad.*	极端；极其；非常
10.	illustration	[ˌilə'streiʃən]	*n.*	①(书、杂志等中的)插图；图表 ②例证；实例 ③说明；图解；图示
11.	initially	[i'niʃəli]	*ad.*	开始；最初
12.	linear	['linə]	*a.*	①线的　②长度的 ③直线的；线状的
13.	magnitude	['mægnitju:d]	*n.*	①巨大；重要性 ②尺度；大小；长度 ③量；量值；数量
14.	quantity	['kwɔntiti]	*n.*	①数目；数量　②量；大小 ③大量；大批；众多；大宗
15.	scale	[skeil]	*n.*	①刻度；规模；级别 ②规模；程度；范围 ③等级；级别
16.	similar	['similə]	*a.*	类似的；同类的；相似的；同样的
17.	simplification	[ˌsimplifi'keiʃən]	*n.*	单纯化；简单化
18.	triangle	['traiæŋgl]	*n.*	①三角形；三角形物体 ②三人一组；三角关系
19.	via	['vaiə]	*prep.*	①(表示方式)通过(某人)；凭借(某种手段)　②(表示关涉)经由；经过
20.	virtually	['və:tʃuəli]	*ad.*	①实际上；事实上　②差不多；几乎
21.	current	['kʌrənt]	*n.*	电流；水流；气流；趋势；倾向
22.	frequency	['fri:kwənsi]	*n.*	频率
23.	spectrum	['spektrəm]	*n.*	光谱；频谱
24.	superposition	[ˌsju:pəpə'ziʃən]	*n.*	叠加
25.	apply to			适用于；运用；致力于，专心于

26.	be related to	与……有关；与……有联系
27.	Fourier relationship	傅里叶关系
28.	in the case of	就……而言；至于……
29.	relevant to	与……有关；相应的
30.	algebraic sum	代数和
31.	circuit element	电路元件
32.	electrical circuit	电路
33.	frequency spectrum	频谱
34.	linear system	线性系统
35.	power	电力；电源
36.	source	电源；信号源
37.	square wave	方波；矩形波
38.	voltage	电压
39.	waveform	波形

Notes

(1) 叠加原理一般形式的具体的解释如下："在仅包含几个独立电压源或电流源的线性电路中，通过电路元件两端的电压及电流是每个电源(电压源和电流源)单独作用在该元件上所产生的电压或电流的代数和。"

(2) If a linear system, which is initially at rest (no offset), is excited by two or more inputs, the total output of the system is the sum of outputs obtained when each input is applied separately with all others setting to zero.

本句包含一个if条件状语从句，which引导的非限定性定语从句和when引导的时间状语从句。真正主语为the total output of the system，表语为the sum of outputs obtained when each input is applied separately with all others setting to zero，其中obtained为the sum of outputs的定语。

(3) The corresponding triangles, in the case of non-linear circuits in Fig. 8.1(b), $x_1 - z_1$, etc. are not similar and therefore the principle of superposition does not apply to them.

其中，in the case of non-linear circuits in Fig. 8.1(b), $x_1 - z_1$, etc.为插入语。

Word-Study

I. Concept, Conception, notion

(1) A **concept** is an idea of how something is or abstract principle how something should be done.

(2) A **conception** of something is an idea about what something is like or a basic understanding of something.

(3) **Conception** is
- a process in which someone forms a plan or idea.
- the process by which a woman or female animal becomes pregnant, or the time when this happens.

(4) A **notion** is an idea, belief or opinion about something, especially one that you think is wrong.

(5) A **notion** is a sudden desire to do something.

It's difficult to grasp the concept of infinite space.

The leaders still have little conception of how democracy works.

Peter is responsible not only for the conception of the show, but also for most of its scripts.

Robert argues that life does not begin at conception.

The problem stems from an unrealistic notion of what teachers do.

At midnight, Shelly had a sudden notion to go to the beach.

II. Be similar to, Be similar with

(1) Somebody/Something **is similar to** somebody/something means they are almost the same, but not exactly the same.

(2) Someone **is similar with** someone else only.

(3) Only the subordinate clause can be added after the phrase ***be similar to***.

Tom's voice is very similar to/with his brother's.

My problems are similar to/with yours.

Wasps look similar to/with bees.

I have no similar with Tom.

By this memory structure, the signal storage function be similar to the magnetic tape recorder can be realized.

III. Apply to, Apply for

(1) **Apply to** means to use something such as a method, idea or law in a particular situation, activity or process.

(2) **Apply for** means to make a formal, usually written request to be considered for a job, an opportunity to study at a college, permission to do something etc..

He applied himself to his new job.

These principles apply to learning maths.

He applied himself diligently to learning French.

He applied for a passport.

I made up my mind to apply for a scholarship.

IV. Relate to, Connect with/to

(1) **Relate to** means to be concerned with or directly connected to a particular subject.

(2) **Relate to** means to be able to have a good relationship with people because you understand their feelings and behavior.

(3) **Relate to** means spoken to feel that you understand or sympathize with a particular idea or situation.

(4) **Connect to** means to join two or more things together.

(5) **Connect with/to** means to realize that two facts, events, or people are related to each other.

(6) **Connect with** sb means having a social or professional relationship with someone.

How does this job relate to your career goals.

Laurie has a hard time relating to children.

I can really relate to that article you sent me.

Mic level output must be connected to the microphone connector on the back of the system.

Everything connected with Christmas is on sale this week.

Aren’t they connected with his father’s business in some way?

V. In case of, In the case of, In case, in any case, in that case

(1) **In case of** sth. used to describe what you should do in a particular situation, especially on official notices.

(2) **In the case of** means under some circumstance, concerning, etc..

(3) **In case**, as a way of being safe from something that might happen or might be true.

(4) **In case** is used like “if”.

(5) **In any case** is used to say that a fact or part of a situation stays the same, even if other things change.

(6) **In that case** is used to describe what you will do, or what will happen, as a result of a particular situation or event.

In case of fire, break the glass and push the alarm button.

It's the kind of story we think of as myth. But in the case of Lincoln, the story is true.

In case he comes, let me know.

Take warm clothes in case the weather is cold.

None of us here has ever been bitten, but in any case the spider's bite is not very poisonous.

—I'll be home late tonight.

—Well, in that case, I won't cook dinner.

Sentence Patterns

I. Nonrestrictive attributive clauses: They are characterized by a comma between the principal and the attributive clause. In comparison with restrictive attributive clauses, non-restrictive attributive clauses hold a loose relationship with the antecedents, functioning and a supplementary part in the sentence.

(1) I told the story to John, (2) His brother, (3) This note was left by Tom,	who	told it to his brother. is eighteen years old, is a PLA man. was here a moment ago.
(4) He passed the exam, (5) All the books there, (6) They are hollow, (7) Fine grains of dust can reflect blue light,	which	he hoped he would. have beautiful pictures in them, were written by him. makes them very light. coarse grains of dust cannot.

(8) This is a college of science and technology, the students of which are trained to be engineers or scientists.

(9) He saw in front that haggard white-haired old man, whose eyes flashed red with fury.

(10) Electrons also flow in a television, where they are made to hit the screen, causing a flash of light.

II. Parenthesis

Parenthesis (rhetoric), either of the ( ) punctuation marks that together make a set of parentheses or an explanatory or qualifying word, clause or sentence; it is often used in farces, especially in the early 17th century. Here are some of the most useful patterns for parenthesis.

True,	It would be too bad.
Wonderful,	we have won again.
Strange to say,	he hasn't got my letter up to now.
Most important of all,	we must learn all the skills.
Indeed,	I really want to stay with you forever.
Surely,	everyone standing here wants to be succeed.
Still,	we cannot go there with you next month.
Otherwise,	he would still be at home.
Certainly,	they were your best friends during your college life.
Besides,	I hope you will be happy eventually.

续表

In fact, In my opinion, In general, In a word, In brief, For example, On the contrary, In conclusion,	we should strengthen our corporation with them.
Generally speaking, Strictly speaking, Judging from by this, Considering my experience,	the weather there is niether too cold in winter nor too hot in summer.
To be frank, To be honest, To be sure, To tell you the truth, To sum up,	I don't quite agree with you
I am sure, I believe, I think, I suppose, I'm afraid, What's more, That is to say, As we know,	china well catch up with the developed countries sooner or later.

Exercises

Ⅰ. Answer the following questions with the information from the passage.

1. What is the superposition?
2. Please analyze the Fig. 8.1(b) in the text.
3. Why the superposition is so important?
4. Why the principle of superposition does not apply directly to calculations of power?

Ⅱ. Choose an appropriate translation from Column B for each of the words in Column A.

	Column A		Column B	
( )	1.	circuit	A.	电流
( )	2.	current	B.	电压
( )	3.	source	C.	电力
( )	4.	voltage	D.	光谱
( )	5.	power	E.	电源
( )	6.	spectrum	F.	电路

Ⅲ. Complete these statements with the proper "content".

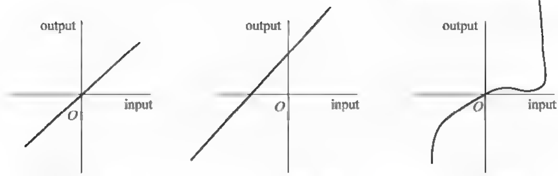
1. Fig. 8.1(a) is in _______ system (linear, non-linear).
2. In Fig. 8.1(a), the corresponding triangles are _______. (similar, simple)
3. The principle of superposition does not _______ directly to calculations of power. (apply, use)
4. Using the most convenient way to describe the behaviour of circuits is extremely useful in _______ all fields of electronics. (fact, virtually)
5. The problem stems from an unrealistic _______ of what teachers do. (concept, conception, notion)
6. Mary's fashionable purse _______ Jane's. (is similar with, is similar to)
7. The law _______ all persons. (applied to, applied for)
8. Aren't they _______ his father's business in some way? (related to, connected to, connected with)
9. Take warm clothes _______ the weather is cold. (in case of, in case, in that case, in the case of)

Ⅳ. Judge the following statements T or F, and tell the reason.

1. She has a sister, that is a teacher.
2. She has a sister, who is teacher.
3. He didn't pass the exam, that disappointed me.
4. He didn't pass the exam, which disappointed me.
5. This is the girl who I met in the street.
6. A young man had a new girl friend, who he wanted to impress.
7. The book, he lost yesterday, has been found.
8. This is the book he lost yesterday.

Reading 8: Linear Systems

In a linear circuit like Fig. 8.2(a), the ratio of the output and the input is a constant. In other words, the magnitude of the output is directly proportional to the magnitude of the input. So, for example, the output can be doubled by simply doubling the input. Note that the transfer functions shown in Fig. 8.2(a) and Fig. 8.2(c) have a zero output when the input is zero (the graph passes through the origin). This is not the case in systems which have an **offset** (the output is not zero when the input is zero) as shown in Fig. 8.2(b). In linear systems with an offset it is the ratio of the change of the output for a given change of input which is constant (the ratio of incremental values) but not that of their absolute values. The models of linear circuits are very much simpler to understand and to analyse than those of non-linear ones.



(a) Linear, no offset (b) Linear with offset (c) Non-linear

Fig. 8.2 Three types of input-output relationships

The passive components of electrical circuits, resistors, inductors and capacitors, the circuit elements, are generally assumed to be linear unless specifically said not to be so. This assumption is reasonable in most cases of circuit analysis. In the practical testing of circuits and devices it is also the case, but obviously there are limits imposed by considerations such as the power dissipation in the components, their insulation ratings etc. So, for example, the relationship between the voltage applied to a resistor and the resulting current flowing through it can be described by a constant quantity, their ratio, called the resistance.

The resistance of a resistor is generally assumed to remain constant regardless of the magnitude of the applied voltage. Consider how much more complicated the calculations would be if the resistance could not be assumed to remain constant. In practice, of course, as the applied voltage is increased the resistor gets warmer, due to the increased power dissipation, and the resistance changes according to the properties of the material it is made of. However, in most (but by no means all) cases the change is assumed to be negligible. Some resistive devices are designed to exhibit a large change of resistance. For example, the resistance of thermistors changes substantially as a function of their temperature, so they can be used to measure temperature.

The linearity of inductors depends on the magnetic material used in their core. Air cored inductors demonstrate good linearity, but this is not generally the case with iron (or ferrite) cored ones. Care must be taken when using the latter to ensure that the device is properly characterized for the purposes of the measurement or calculation.

Capacitors can, generally, be assumed to be linear when used within the specified operating limits.

Semiconductor devices are all non-linear when considered over their full operating range. However, linear models are often used over a very small part of the operating range[9].

Unit 9

Text 9: Low Pass Filters

Consider the circuit shown in Fig. 9.1. Note similarities to the RC circuit that we used to first understand the effects of a capacitor. The difference is that now we are going to apply an AC signal to the input rather than the step input we applied before.

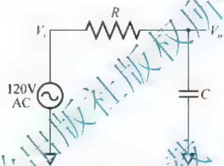


Fig. 9.1 Cap-based low pass filter

This circuit is known as a low pass filter and all you really need to know is to understand that it is the voltage-divider rule and how a capacitor reacts to frequency. If this were a simple voltage divider, you could figure out, based on the ratio of the resistors, how much voltage would appear at the output. Remember that the cap is like a resistor that depends on frequency and try to extrapolate what will happen as frequency sweeps from zero to infinity.

At low frequencies the cap doesn't pass much current, so the signal isn't affected much. As frequency increases, the cap will pass more and more current, shorting the output of the resistor to ground and dividing the output voltage to smaller and smaller levels. There is a magic point at which the output is half the input. It is when the frequency equals 1/RC. You might have noticed that this is the inverse of the time constant that we used earlier when we first looked at caps. Kinda cool when it all comes together, isn't it?

It is known as a low pass filter because it passes low frequencies while reducing or attenuating high frequencies. You can make a low pass filter with an inductor and resistor, too. Given that the inductor behaves in a way that is opposite of a capacitor, can you imagine what that might look like? Have a look at Fig. 9.2 .

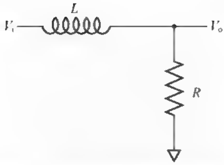


Fig. 9.2 Inductor-based low pass filter

Here, you need to swap the position of the components. That's because the inductor (being the opposite of a cap) passes the lower frequencies and blocks the higher frequencies. It performs the same function as the low pass RC circuit but in a slightly different manner. You still have a voltage-divider circuit, but instead of the resistor-to-ground changing, the input resistor is changing. At low frequencies the inductor is a short, making the ground resistor of little effect. As frequencies increase, the inductor chokes off the current, reacting in a way that makes the input element of the voltage divider seem like an increasingly large resistance. This in turn makes the resistor to ground have a much bigger say in the ratio of the voltage-divider circuit.

To summarize, in the low pass filter circuits, as the frequencies sweep from low to high, the cap starts out as an open and moves to a short while the inductor starts out as a short and becomes an open. By positioning these components in opposite locations in the voltage-divider circuit, you can create the same filtering effect. The ratio of the voltage divider in both types of filters decreases the output voltage as frequencies increase. All this lets the low frequencies pass and blocks the high frequencies. Now, what do you suspect might happen if we swap the position of the components in these circuits[10]?

Words and Expressions

1.	similarity	[ˌsiməˈlæriti:]	*n.*	①类似；相似 ②相像性；相仿性；类似性
2.	extrapolate	[ikˈstræpəˌleit]	*v.*	推算；推断
3.	sweep	[swi:p]	*v.*	①扫；打扫；拂去；扫去 ②扫视；掠过；搜索 ③蜿蜒；呈缓坡延伸 ④突然袭来
4.	attenuate	[əˌtenju:ˈeit]	*v.*	①(使)变细；(使)变薄 ②减弱；贬值 ③稀薄的；细小的

5.	component	[kəm'pəunənt]	*n.*	①成分；组成部分
				②(混合物的)组成部分
				③[数学]分量
6.	block	[blɔk]	*n.*	①大块木料大块；方块
				②障碍；阻塞
				③成块的；块形的
7.	perform	[pə'fɔ:m]	*v.*	①执行；履行
				②表演；扮演
				③运行；表现；工作；运转
8.	slightly	['slaitli]	*ad.*	①轻微地；稍稍
				②细长；苗条；微小
9.	increasingly	[en'taiəli]	*ad.*	日益；越来越多地
10.	summarize	['sʌməraiz]	*v.*	总结；概括
11.	opposite	['ɔpəzit]	*prep.*	(表示位置)在……的对面
			a.	①对面的；相反的，对立的
				②[数学](项、边等)对的
			n.	③对立面；对过
12.	location	[ləu'keiʃən]	*n.*	①位置；场所
				②发现[找出]……的位置[地点]
13.	decrease	[di:'kri:s]	*v.*	①减少；减小
				②递减
14.	react	[ri'ækt]	*v.*	①起反应；作出反应
				②反对；对抗
15.	rather than			而不是
16.	figure out			计算出；解决；理解
17.	be based on			基于
18.	in a manner			在一定程度上
19.	choke off			终止；阻止；中断
20.	in a way			在某种程度上
21.	start out			开始；着手；启动
22.	low pass filter			低通滤波器
23.	capacitor			电容，电容器

24. voltage-divider rule 分压器规则
25. cap 电容
26. inductor 感应器

Notes

(1) 低通滤波器。它是容许低于截至频率的信号通过，但高于截止频率的信号不能通过的电子滤波装置。低通滤波器概念有许多不同的形式，其中包括电子线路(如音频设备中使用的 hiss 滤波器、平滑数据的数字算法、音障(acoustic barriers)、图像模糊处理等，这两个工具都通过剔除短期波动、保留长期发展趋势提供了信号的平滑形式。

(2) The difference is that now we are going to apply an AC signal to the input rather than the step input we applied before.

本句为 that 引导的表语从句。其中，rather than 可译为：而不是，与其……不如……。”它可作为一个连词词组，用来连接两个并列成分，表示在两者中进行选择，意为“是 A 而不是 B”、“要 A 不要 B”、“宁愿 A 而不愿 B”。后面可以接名词、名词短语、代词、形容词、副词、动词、不定式、动名词等，侧重客观上的差别，还可以表示“与其……，倒不如(或宁可)……”，侧重句子主语或说话人主观上的选择。

(3) This circuit is known as a low pass filter, and all you really need to know to understand it is the voltage-divider rule and how a capacitor reacts to frequency.

本句为 and 连接的并列句，在第二个句子中，all 为主语，is 为系动词，表语为一个名词组和一个从句子。译文为：该电路称为低通滤波器，我们需要做的就是去真正理解分压理论以及电容是如何影响频率的。

(4) Now, what do you suspect might happen if we swap the position of the components in these circuits?

what 引导的主语从句中包含一个 if 引导的虚拟语气句。译文为：现在，如果我们在这些电路中调换元件的位置，可能会发生什么样的情况？

Word-Study

I. rather than, would rather, not…but rather

(1) **Rather than** a phrase meaning “instead of”, used when you are comparing two things or situations.

(2) **Would rather** used when you would prefer to do or have one thing more than another.

(3) **Not…but rather…**used to say that someone does not do something but does something else instead.

(4) **Rather** is not used before than when you are comparing people or things. But it is used when you are using adjectives to compare.

Rather than fly directly to LA, why not stop in San Francisco first?

I prefer cooking with olive oil rather than butter.

We could eat later, if you would rather do that.

Tina would rather die than apologize to Doug.

The problem is not their lack of funding, but rather their lack of planning.

Books are more interesting than TV.

TV is relaxing rather than interesting.

II. in a way, in a sense, in no sense

(1) **In a way** used to say that something is partly true, or to make a statement weaker.

(2) **In a sense**——in one particular way, but without considering all the other facts or possibilities.

(3) **In no sense** used to emphasize that something is definitely not true.

In a way, I'm a little surprised he accepted the offer.

The whole point of a screen saver program is, in a sense, to do nothing at all.

Social Security is in no sense an insurance program.

Gray's comments should in no way be considered official policy.

III. start out, go about, set about

(1) **Start out** means to begin happening or existing in a particular way, especially when this changes later.

(2) **Start out** is to begin your life, profession or an important period of time.

(3) **Start out** is to begin a trip, or begin moving in a particular direction.

(4) **Go about** means to do something or begin working at something.

(5) **Set about** means to start doing something especially something that needs a lot of time and effort.

"The star" started out as a small weekly newspaper in 1933.

When we were just starting out, no one came to our concerts.

They had just started out when Peggy's horse began to gallop.

The way with which you'll go about the task really matters.

Let's go about the work separately.

We set about our task at once with great enthusiasm.

He set about his task in a workmanlike way.

Sentence Patterns

I. predicative clause: A predicative clause is a subordinate clause that functions as a predicative of the main clause.

1. The problem is
   - that he can arrive at the hotel.
   - what he wanted to be ten years ago.
   - when we can get a pay rise.
   - who will travel with me to Beijing tomorrow.
   - why he cried yesterday.
   - where we can stay for enjoying our holiday.
   - which is best choice for you.
   - whether you go or not.
   - how we can get the things we need.
2. That is
   - why you see this old woman before you know, Jeanne.
   - why I came.
   - why I cannot agree.
   - why they came to China for interview.
3. That is because
   - he had to help his little sister with her homework
   - more than 90%of the students had been admitted to key universities.
   - Mr. Smith had arrived yet.
   - she had done a great thing.
   - you eat too much.

II. Subjunctive Mood

Contrary to the present	Subject + should/would/could/might + do + else + if + subject + did/be(were) + else	(1) If I were you, I would take an umbrella. (2) If I knew his telephone number, I would tell you. (3) If there were no air or water, there would be no living things on the earth. (4) If I had any money with me, I could lend you some. (5) If he studied harder, he might pass the exam.
Contrary to the past	Subject + should/would/could/might + have done + else + if + subject + had done + else	(1) If I had got there earlier, I should/could have met her. (2) If he had taken my advice, he would not have made such a mistake.
Contrary to the future	Subject + should/would/could/might + do + else + if + subject + did/should/were to do + else	(1) If he should come here tomorrow, I should/would talk to him. (2) If there were a heavy snow next Sunday, we would not go skating. (3) If she were to be there next Monday, I would tell her about the matter.

Exercises

Ⅰ.Answer the following questions with the information from the passage.

1. What do you know about IC circuit?
2. Why is it important for understanding a low pass filter?
3. What are the differences between cap based low-pass filter and inductor-based low pass filter?
4. Please analyze the principle of low pass filter with your own words.

Ⅱ. Choose an appropriate translation from Column B for each of the words in Column A.

		Column A	Column B
( )	1.	choke off	A. 元件
( )	2.	extrapolate	B. 运行
( )	3.	component	C. 启动
( )	4.	opposite	D. 推断
( )	5.	ratio	E. 相反的
( )	6.	perform	F. 比率
( )	7.	start out	G. 切断

Ⅲ. Complete these statements with the proper "content".

1. The ratio of the voltage divider in both types of filters _______ the output voltage as frequencies increase. (decreases, increases)
2. At low frequencies the inductor is a short, making the ground resistor of _______ effect. (much, little)
3. About _______, we should know to understand it is the voltage-divider rule and how a capacitor reacts to frequency. (Cap-based low-pass filter, low-pass filter, Inductor-based low-pass filter)
4. Books are _______ (rather, more) interesting than TV.
5. They _______ (would rather, rather) walk.

Ⅳ. Judge the following statements T or F, and tell the reason.

1. The question is when can he arrive at the hotel.
2. The question is when he can arrive at the hotel.
3. The question is if the enemy is marching towards us.
4. The question is whether the enemy is marching towards us.
5. It looked as if he had understood this question.
6. The question is who will travel with me to Beijing tomorrow.

7. The question is why he cried yesterday.
8. The question is we will go with our parents.

Reading 9: Active Filters

So far we have been studying passive filters. A passive component is one that is not powered externally. Being passive, these components are subject to an effect known as loading. This means that anything you hook up to the output can affect the performance of the filter. Take a low pass RC filter for example and hook a resistor up to it, as shown in Fig. 9.3.

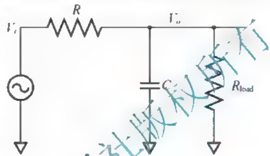


Fig. 9.3 Filter with load

This resistor on the output is a load. It could be another part of the circuit or any number of things, but the point is that it acts like a resistor to ground. How does this affect the RC filter performance? To understand, let's Thevenize it to "see" how the load affects the output. We start by shorting the voltage source to ground. This is done with AC sources the same as DC, so the circuit would look like Fig. 9.4.

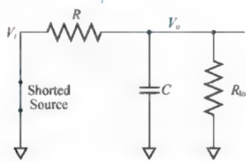


Fig. 9.4 Thevenized circuit shows effect of load

Let R=10k and let R_{load}=10k and C=0.1μf. When you Thevenize a circuit, you reduce all the parts into one, where possible. In this case the resistors are in parallel, so you can apply the parallel rule to the resistors and get a value of 5kΩ. Did you notice that the R value has changed considerably due to the load on the circuit? What might seem counterintuitive at first is the fact that the time constant of this circuit is a function of the Thevenized version that we just derived. So, without the load, τ would have been 10k×0.1μs, or 1ms.

With the load, it is 0.5ms, half what it was before. Since the output of this filter depends on τ, we can see that the load has affected it significantly. A way to avoid this problem is to add an active component to the design, making it into an "active" filter. In adding such a component, the basic idea is to minimize this loading effect to a point that you get a nice predictable response. The output of the active filter is such that no matter what load you put on it, it does not affect the response of the filter, as is shown in Fig. 9.5.

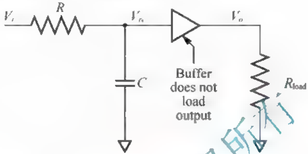


Fig. 9.5 Active buffer eliminates the effect of the load

The input of this active device (known as an op-amp) has a very high impedance. In this case it is comparable to a 10-meg resistor. Hooking that up to the RC filter will have little effect on the time constant of this circuit as long is it is significantly larger than the R value in the circuit. The buffer in this circuit will output a voltage that matches the voltage on the input. It will buffer the signal; no matter what you hook up to the output, the filter will not be affected. This is one of the simplest active filters, but the principle with all of them is the same — including an active element to preserve or enhance the integrity of the filter[10].

Unit 10

Text 10: RFID Systems

RFID may only consist of a tag and a reader, but an RFID system comprises many other technologies, such as computer, network, Internet, wireless devices and software, all working with the RFID devices to create a complete solution. A typical RFID system is divided into two layers: the physical layer and Information Technology (IT) layer.

The physical layer consists of the following contents:

(1) One or more RF tags.

(2) One or more interrogators (readers).

(3) One or more reader antennas.

(4) Deployment environment.

The IT layer consists of the following contents:

(1) One or more host computers connected to readers (directly or through a network).

(2) Appropriate software (device drivers, filters, middleware, databases, and user applications).

Fig. 10.1 provides a bird's-eye view of the RFID system, showing tags, readers, network, computers with software applications and people all interacting to monitor and control business processes. The bidirectional mode of data movement among various parts of the RFID system is depicted at the bottom of the figure. Data may be read from or written to the tag during a business process. For example, a number may be read from the tag attached to a case of goods passing through the shipping dock, while data may be written to the tag attached to a part moving from one workstation to the other during the manufacturing process.

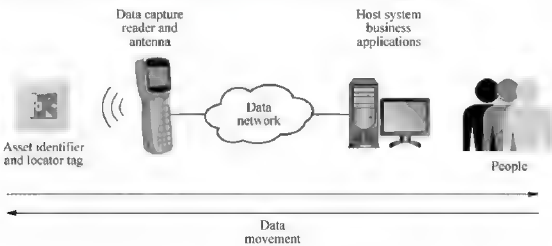


Fig. 10.1 Bird's-eye view of an RFID system

Fig. 10.2 shows the physical layer of an RFID system: a tag, an antenna, a reader, and the deployment environment. The deployment environment consists of an interrogation zone (IZ) —the space in which a reader antenna emits radio waves through which the tags pass—and objects in the vicinity of the IZ. The deployment environment is included in the physical layer because the performance of the RFID reader and tag is greatly affected by various characteristics of the deployment environment. The radio frequency interference within the deployment space and the type, size, and shape of objects located within the deployment space affect the read performance of tags.

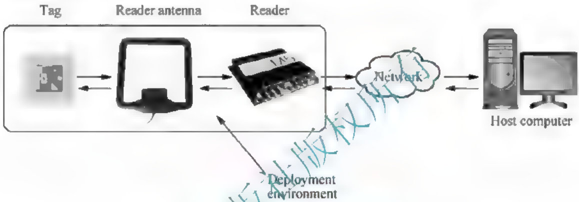


Fig. 10.2 The physical layer of the RFID system

All RFID systems require IT layer components. The IT layer consists of various computer systems, networks, databases and application software. RFID software is divided into two groups: middleware and enterprise applications. Middleware directly interacts with the RFID physical layer, collects data from readers, attaches business process information to data, stores data, and supplies data to enterprise applications in their native formats. It also manages, monitors and configures hardware. Middleware forms a conduit between the enterprise applications used to manage business processes and hardware components. Enterprise applications, also called business applications, use middleware to gather data from RFID readers. This data is then used to manage business. For example, data received from RFID readers at shipping dock may be used to create invoices and bill customers.

Varieties of RFID tags, readers, and antennas are available on the market. The RFID system designer selects them according to the requirements of the objects to be tagged, the distance at which the tags are to be read, the business processes during which tags are read, the speed of the tagged objects through the IZ and the number of tags in the IZ. RFID tags come in many different shapes and sizes, it can operate at different frequencies, use different protocols, obtain power from different sources, and it can be written to once or several times and currently cost anywhere from ten cents to several dollars. RFID readers are designed to operate at different frequencies, protocols and power levels. RFID antennas also come in different sizes, shapes, frequencies and with different radiation patterns[11].

Words and Expressions

1.	tag	[tæg]	*n.*	①标签，签条，标牌 ②名言，警句，引语，格言，谚语
2.	reader	['ri:də]	*n.*	①阅读器 ②读者
3.	comprise	[kəm'praiz]	*v.*	①包含，包括，由……组成 ②组成，构成
4.	software	['sɔftwɛə]	*n.*	软件
5.	device	[di'vais]	*n.*	①[计算机](具有专门功能的)硬件设备 ②装置，设备，器具
6.	interrogator	[in'terəˌgeitə]	*n.*	①询问器 ②讯问者；审问者；质问者
7.	antenna	[æn'tenə]	*n.*	①天线 ②触角，触须
8.	bidirectional	[baidi'rekʃənəl]	*a.*	双向的
9.	depict	[di'pikt]	*v.*	①描绘；描画 ②描写；描述；刻画
10.	workstation	['wə:ksteiʃən]	*n.*	工作站，工作区
11.	vicinity	[vi'siniti]	*n.*	①近，接近，密切 ②附近，邻近
12.	interference	[ˌintə'fiərəns]	*n.*	①干涉；干预；介入 ②阻碍，(无线电信号的)干扰
13.	component	[kəm'pəunənt]	*n.*	①成分，部件，元件 ②(混合物的)组成部分；成分；要素
14.	configure	[kən'figə]	*v.*	配置，设定，使成形，使具一定形式
15.	conduit	['kɔndit]	*n.*	①[电]管道，水管，导电管 ②中转人；中转机构；中转国
16.	variety	[və'raiəti]	*n.*	①品种，种类 ②变化，多样化 ③(基于遗传差异的)变种
17.	protocol	['prəutəkɔl]	*n.*	①协议 ②礼仪 ③(外交条约的)草案，草约；
18.	consist of			由……组成；由……构成
19.	RFID systems			射频识别系统
20.	deployment environment			环境部署
21.	host computer			主机
22.	user applications			用户应用程序

23. business process 商务处理
24. data movement 数据传送
25. interrogation zone 询问区
26. enterprise applications 企业应用程序
27. native format 本机格式，原始格式

Notes

(1) 本单元简要介绍了射频识别系统的基本原理以及射频识别系统的构成，并结合具体实例对个别组件的作用进行了介绍。

(2) 相对于传统的磁卡及 IC 卡技术射频识别(RFID)技术具有非接触、阅读速度快、无磨损等特点，其在最近几年里得到快速发展。为加强中国工程师对该技术的理解，本文详细介绍了 RFID 技术的工作原理、分类、标准以及相关应用。

(3) 最基本的 RFID 系统由以下 3 部分组成。①标签(Tag，即射频卡)。由耦合元件及芯片组成，标签含有内置天线，用于和射频天线间进行通信。②卡读器。读取(在读写卡中还可以写入)标签信息的设备。③天线。在标签和读取器间传递射频信号。

(4) Middleware forms a conduit between the enterprise applications used to manage business processes and hardware components.

正确理解该句的关键是 between…and…这一短语。全句应译为：中心层也能管理、监控，并配置硬件系统，其建立了从商业管理的企业应用软件到硬件系统的通道。

Word-Study

Vary, Various, Variant, Variation, Variety, Variability

(1) **Vary** means to be different from each other in size, shape, etc.

(2) **Various** means several different.

(3) **Variant** refers a thing that is a slightly different form or type of something else.

(4) **Variation** refers a change, especially in the amount or level of something.

(5) **Variety** refers several different sorts of the same thing.

(6) **Variability** means the fact of something being likely to vary.

The quality of this new kind laptop varies considerably.

There are various way do to this job.

This object is called a variant form of oxygen known as ozone.

The dial records very slight variations in pressure.

There is a wide variety of patterns to choose from.

As a bank clerk, you should learn about the degree of variability in the exchange rate.

Sentence Patterns

Comprise, Compose, Consist of, Constitute, Make up, Include

Notes:

When you want to mention the different parts that something is formed form, you can say that something **comprises, consist of, is composed of** or **is made up** of number of different things.

You can also say **is comprised of**, though this use is often avoided in written English. It is not correct to use **comprises of** or **is composed by/from**.

When you mention first all the parts that together from the whole, constitute, **compose** and **make up** are used. **Comprise** also can be used in this way but is less common.

You can use **include** if you only mention some of the parts.

These verbs above are not used in the progressive tenses.

(1) An RFID system { comprises / consists of / is composed of / is made up of } many other technologies.

(2) A tag and a reader { compose / make up / constitute } a RFID.

(3) The committee comprises two lawyers, two journalists and a head teacher.

(4) Two layers, two journalists and a head teacher compose the committee.

(5) The British Parliament comprises the House of Commons and the House of Lords.

(6) The House of Commons and the House of Lords constitute the British Parliament.

Exercises

Ⅰ. Answer the following questions with the information from the passage.

1. What does an RFID system comprise?
2. How many layers does a typical RFID system have? And what are they?
3. What does the physical layer consist of?
4. What does the IT layer consist of?
5. Where is the bidirectional mode of data movement depicted?
6. What does the deployment environment consist of?

7. Why the deployment environment is included in the physical layer?
8. How many groups are RFID software divided? And what are they?
9. Can you say something about the usage of middleware?
10. How does the RFID system designer select the RFID components?

Ⅱ. Choose an appropriate translation from Column B for each of the words in Column A.

		Column A		Column B
( )	1.	antenna	A.	适当的，合适的
( )	2.	workstation	B.	描绘；刻画
( )	3.	device	C.	工作站，工作区
( )	4.	tag	D.	元件，
( )	5.	appropriate	E.	天线
( )	6.	bidirectional	F.	变化，多样化
( )	7.	depict	G.	包含，组成，构成
( )	8.	comprise	H.	[计算机]硬件设备
( )	9.	performance	I.	性能；特性
( )	10.	component	J.	标签，签条，标牌
( )	11.	variety	K.	软件
( )	12.	protocol	L.	配置，设定，使成形，使具一定形式
( )	13.	configure	M.	询问器
( )	14.	interrogator	N.	协议
( )	15.	software	O.	双向的

Ⅲ. Fill in the blanks with the words given below. Change the form when necessary.

comprise	interference	depict	monitor
appropriate	protocol	component	performance

1. They were _______ the upper air to collect evidence of atomic explosions.
2. Are you satisfied with the _______ of your new car?
3. It is _______ that he should get the post.
4. The fishing fleet _______ around 70 boats.
5. A chemist can separate a medicine into its _______.
6. They _______ the thrilling situation to us in great detail.
7. I couldn't hear the program because there was too much _______.
8. We must observe the correct _______.

Reading 10: Auto-ID Technologies

Auto-ID technology is anything that collects data about the objects and enters that data into a database without human intervention. Auto-ID technologies are everywhere, quietly and efficiently doing thousands of mundane jobs. The one big job where Auto-ID makes a natural fit is in answering some of the big questions of commerce: “What is it?”, “Where is it?” and “What about it?”—primarily the identification and tracking of boxes, people, animals, you name it. Compared to humans, Auto-ID technologies identify and track faster, more accurately and at a reduced overall cost. RFID is only one of many types of Auto-ID technologies. Other Auto-ID technologies include Magnetic Ink Character Recognition (MICR), magnetic strip, voice recognition, biometrics and barcodes.

MICR reads ink-printed characters, such as those that often appear at the bottom of personal checks. The checks must be properly oriented and presented to the MICR reader at a time. Magnetic strips are used on credit and debit cards and also require a proper orientation and physical contact between the card and the reader. Barcodes consist of a series of black bars and white spaces of varying widths. Several hundred different types of barcodes are used, with the most common being the Uniform Product Code (UPC), which is used extensively by the retail industry. Barcodes require a line of sight and proper orientation of the barcodes relative to the scanner. Voice recognition is used by order-picking applications in distribution centers (DCs). In order picking, voice recognition has a big advantage over barcode identification. It allows hands-free and eyes-free order picking and does not require alignment of labels to readers. Biometrics, such as fingerprint and retinal scans, are used to identify people. Many of the latest computers use fingerprints to identify the user. In many highly secured locations, entry permits are granted using retinal scans. Retinal scanning has also been used to identify cattle.

So, with all these Auto-ID technologies, why should yet another technology like RFID suddenly becomes so popular? It all boils down to one thing: radio waves. RFID encompasses technologies that use electromagnetic (radio) waves, part of electromagnetic spectrum, to identify individual items, places, animals or people. RFID can be appropriately implemented for many different uses. The most common is to use an identifying number (sort of a name) that uniquely identifies an object, place, animal or person. The number is stored on an integrated circuit (IC) that is attached to an antenna. Together, the IC and the antenna are called an RFID transponder or tag. The tag is attached to the object, place, animal or person to be identified. A device called the interrogator or reader communicates with the tag and it is used to read the identifying number from the tag. The reader feeds the number it reads into an information system, which stores the number in its database or searches its database for the number and returns information stored which is about the object, place, animal or person. The major difference between various Auto-ID technologies is in how the identifying number is stored and retrieved[11].

Unit 11

Text 11: Fixed-Function Integrated Circuits

All the logic elements and functions that have been discussed are generally available in integrated circuit (IC) form. Digital systems have incorporated ICs for many years because of their small size, high reliability, low cost and low power consumption. It is important to be able to recognize the IC packages and to know how the pin connections are numbered, as well as to be familiar with the way in which circuit complexities and circuit technologies determine the various IC classifications.

A monolithic integrated circuit (IC) is an electronic circuit that is constructed entirely on a single small chip of silicon. All the components that make up the circuit—transistors, diodes, resistors, and capacitors—are an integral part of that single chip. Fixed-function logic and programmable logic are two broad categories of digital ICs. In fixed-function logic, the logic functions are set by the manufacturer and cannot be altered.

Fig. 11.1 shows a cutaway view of one type of fixed-function IC package with the circuit chip shown within the package. Points on the chip are connected to the package pins to allow input and output connections to the outside world.

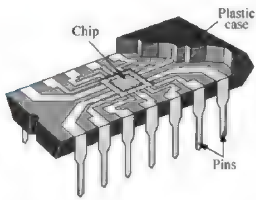


Fig. 11.1 Cutaway view of one type of fixed function IC package showing the chip mounted inside, with connections to input and output pins

IC Packages: Integrated circuit (IC) packages are classified according to the way they are mounted on printed circuit (PC) boards as either through-hole mounted or surface mounted. The through-hole type packages have pins (leads) that are inserted through holes in the PC board and

can be soldered to conductors on the opposite side. The most common type of throughhole package is the dual in-line package (DIP) shown in Fig. 11.2(a).

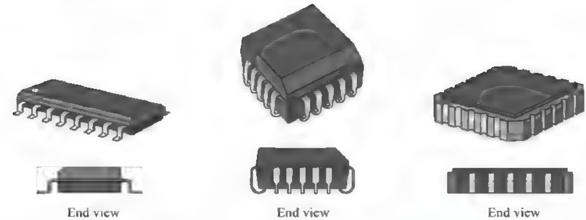
(a) Dual in-line package (DIP) (b) Small-outline IC (SOIC)

Fig. 11.2 Examples of through-hole and surface-mounted devices. The DIP is larger than the SOIC with the same number of leads. The DIP is approximately 0.785 in. long, and the SOIC is approximately 0.385 in. long

Another type of IC package uses surface-mount technology (SMT). Surface mounting is a space-saving alternative to through-hole mounting. The holes through the PC board are unnecessary for SMT. The pins of surface-mounted packages are soldered directly to conductors on one side of the board, leaving the other side free for additional circuits. In addition, for a circuit with the same number of pins, a surface-mounted package is much smaller than a dual in-line package, because the pins are placed closer together. An example of a surface-mounted package is the small-outline integrated circuit (SOIC) shown in Fig. 11.2(b).

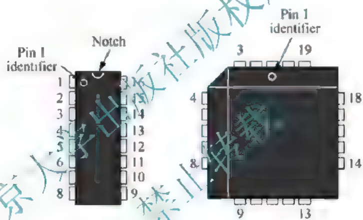
Three common types of SMT packages are the SOIC (small-outline IC), the PLCC (plastic leaded chip carrier), and the LCCC (leadless ceramic chip carrier). These types of packages are available in various sizes depending on the number of leads (more leads are required for more complex circuits). Examples of each type are shown in Fig. 11.3. As you can see, the leads of the SOIC are formed into a “gull-wing” shape. The leads of the PLCC are turned under the package in a J-type shape. Instead of leads, the LCCC has metal contacts molded into its ceramic body. Other variations of SMT packages include SSOP (shrink small-outline package), TSSOP (thin shrink small-outline package) and TVSOP (thin very small-outline package).

Pin Numbering: All IC packages have a standard format for numbering the pins (leads). The dual in-line packages (DIPs) and the small-outline IC packages (SOICs) have the numbering arrangement illustrated in Fig. 11.4(a) for a 16-pin package. Looking at the top of the package, pin 1 is indicated by an identifier that can be either a small dot, a notch, or a beveled edge. The dot is always next to pin 1. Also, with the notch oriented upward, pin 1 is always the top left pin, as indicated. Starting with pin 1, the pin numbers increase as you go down, then across and up. The highest pin number is always to the right of the notch or opposite the dot.



(a) SOIC with "gull-wing" leads (b) PLCC with J-type leads (c) LCCC with no leads (contacts are part of case)

Fig. 11.3 Examples of SMT package configurations



(a) DIP or SOIC (b) PLCC or LCCC

Fig. 11.4 Pin numbering for two standard types of IC packages. Top views are shown

The PLCC and LCCC packages have leads arranged on all four sides. Pin 1 is indicated by a dot or other index mark and is located at the center of one set of leads. The pin numbers increase going counterclockwise as viewed from the top of the package. The highest pin number is always to the right of pin 1. Fig. 11.4(b) illustrates this format for a 20-pin PLCC package[4].

Words and Expressions

1. alter	['ɔ:ltə]	*n.*	改变；变更
2. available	[ə'veiləb(ə)l]	*a.*	①可用的 ②可获得的
3. classification	[ˌklæsifi'keiʃən]	*n.*	①分类；分级 ②类别；种类；门类

4. construct	['kan,strʌkt]	*v.&n.*	①修建；建立；建筑；建造 ②构成；组成 ③组成；创建；编制；绘制
5. consumption	[kən'sʌmpʃən]	*n.*	①消费；消耗；消费[耗]量 ②耗尽；用完
6. dot	[dɔt]	*n.&v.*	①点；小圆点 ②布满；点缀
7. entirely	[en'taiəli]	*ad.*	全部地；完整地；完全地
8. incorporate	[in'kɔ:pəreit]	*v.*	①包含；加上；吸收 ②把……合并；使并入 ③组成公司 ④使具体化；体现；使混合
9. index	['indeks]	*n.*	①标志；象征；量度 ②[数]指数；幂
		v.	指示；表示；迹象
10. indicate	['indikeit]	*n.&v.*	①标示；指示；指出 ②象征；表明或暗示…的可能性
11. insert	[in'sə:t]	*n.&v.*	①插入；嵌入 ②(在文章中)添加；加插
12. integral	['intigrəl]	*a.*	①构成整体所必需的 ②完整的；完备的
13. monolithic	[ˌmɔnə'liθik]	*a.*	①整体的 ②庞大的
14. oriented		*a.*	①导向的；面向……的 ②以……为方向的
15. recognize	['rekəgnaiz]	*v.*	①认出；识别出某人[某事物] ②承认[认清](某事物)；认识到 ③察觉；意识到
16. reliability	[riˌlaiə'biləti]	*n.*	可靠；可信赖
17. silicon	['silikən]	*n.*	硅，矽
18. transistor	[træn'sistə]	*n.*	晶体管
19. diode	['daiəud]	*n.*	(电子) 二极管

20. resistor	[rɪ'zɪstə]	*n.*	电阻器
21. capacitor	[kə'pæsɪtə]	*n.*	电容；电容器
22. cutaway	['kʌtwei]	*n.*	剖面图
23. conductor	[kən'dʌktə]	*n.*	导体
24. notch	[nɔtʃ]	*n.*	切口；凹口
25. chip	[tʃip]	*n.*	缺口；碎片；芯片
26. pin	[pin]	*n.*	引脚
27. be connected to			与……连接；有关联
28. be familiar with			熟悉；了解
29. as well as			既……又；除……之外
30. make up			组成；构成
31. integrated circuit			集成电路
32. digital systems			数字系统
33. fixed-function logic			固定功能逻辑
34. programmable logic			可编程逻辑
35. through-hole type packages			通孔式封装
36. dual in-line package			双列直插式封装
37. surface-mount technology			表面贴装技术
38. identifier			标识
39. beveled edge			斜边
40. counterclockwise			逆时针方向的

Notes

(1) 根据印制电路板的安装方式，集成电路(IC)封装可分为通孔式或表面组装式。通孔式封装有嵌入印制电路板孔的引脚(铅片)，并能与对面导体焊接。表面组装技术无须穿过印制电路板孔，就能与导体直接焊接。表面组装封装要远远小于双列直插式封装。

(2) 表面组装封装有 3 种常见类型：SOIC(小外形集成电路)、PLCC(塑封引脚芯片载体)和 LCCC(无引脚陶瓷芯片承载器)。不同类型尺寸封装的使用取决于管脚的数量(管脚越多，要求电路越复杂)。

(3) It is important to be able to recognize the IC packages and to know how the pin connections are numbered, as well as to be familiar with the way in which circuit complexities and circuit technologies determine the various IC classifications.

It 为形式主语，真正的主语是不定式。how 在并列不定式主语中引导一个宾语从句，as well as 连接并列主语，其中 in which 引导一个定语从句。

Word-Study

I. Be familiar with/to, Be acquainted with

(1) **Be familiar with/to** sth/sb means to know something well because you have seen it, read it, or used it many times before.

(2) **Be familiar with** means having a thorough knowledge of something.

(3) **Be acquainted with** formally means to know something well because you have seen it, read it, or used it many times before.

(4) **Be acquainted with** sb means to know someone, especially because you have met them once or twice before.

I'm not familiar with this computer.

His name is familiar to all of us.

I am not really familiar with the taxation laws here.

All our employees are fully acquainted with safety precautions.

We are already acquainted with each other.

II. As well as, as well

(1) **As well as** means in addition to something else.

(2) **As well** means in addition to something or someone else.

The organization encourages members to meet on a regular basis, as well as providing them with financial support.

I, as well as you, know that.

Did Joe go as well?

III. Make up

(1) **Make** sth. **up**
- means to invent a story, explanation etc. in order to deceive someone.
- means to prepare or arrange something by putting things together.
- means to combine together to form a particular system, group, result etc.
- means to work at times when you do not usually work, so that you do all the work that you should have done.

(2) **Make** sb. **up** means to put special paint, color etc. on someone's face in order to change the way they look.

Tom makes up stories to amuse his little brother.

Why don't you make up a list of what we need from the store?

Mary and Joan quarreled, but made up after a while.

Vitamin pills make up what you lack in your diet.

She had to make up her income as a pianist by teaching piano students.

It didn't take her long to make up.
How many countries make up the Common Market?

Sentence Patterns

Subject Clause: (grammar) a clause that is the subject of a sentence.

(1) That he finished writing the composition in such a short time surprised us all.

(2) Whether we will go for an outing tomorrow remains unknown.

(3) Who will be our monitor hasn't been decided yet.

(4) Whom we must study for is a question of great importance.

(5) What caused the accident remains unknown.

(6) Whatever you did is right.

(7) Who the watch belongs to is unknown.

(8) What we need { is time. / are good doctors.

(9) It is {
certain that he will win the match.
true that he has made a very important discovery in chemistry.
very likely that they will hold a meeting.
strange that he should do that.
important that we all should attend the meeting.
strange that the man should have stuck to his silly ideas.
a pity that we won't be able to go to the south to spend our summer vacation.

Exercises

Ⅰ. Answer the following questions with the information from the passage.

1. What is a monolithic integrated circuit?
2. What are the two broad categories of digital ICs?
3. What are the differences between the through-hole mounted and surface mounted?
4. How to number the pins?

Ⅱ. Choose an appropriate translation from Column B for each of the words in Column A.

	Column A	Column B
( )	1. IC	A. 小外形集成电路
( )	2. DIP	B. 无引线芯片承载封装
( )	3. SMT	C. 集成电路
( )	4. SOIC	D. 塑封式引线芯片承载封装

( )	5.	PLCC	E.	薄型缩小外形封装
( )	6.	LCCC	F.	表面贴装技术
( )	7.	TSSOP	G.	双列直插式封装

Ⅲ. Complete these statements with the proper "content".

1. Digital systems have incorporated ICs for many years because of their_______ size, _______reliability, _______cost and low power consumption. (high, small, low)

2. _______on the chip are connected to the package pins to allow input and output connections to the outside world. (Pins, Leads, Points)

3. _______packages are classified according to the way they are mounted on printed circuit (PC) boards as either through-hole mounted or surface mounted. (SOIC, IC, SMT)

4. The PLCC and LCCC packages have leads arranged on all _______ sides. (four, eight)

5. I'm not _______ warehouse process. (familiar with, familiar to, acquainted with)

6. His name is _______ all of us. (familiar with ,familiar to)

7. All our employees are fully _______ safety precautions. (familiar with, acquainted with)

8. Ass _______ pitcher have ear. (as well as, as well)

Ⅳ. Change the two simple sentences into a subject clause.

1. Somebody said that. He has gone to Shanghai.
2. Something happened. The two cheats were there.
3. What do you need? It is time.
4. Who will be our monitor. That hasn't been decided yet.
5. He finished writing the composition in such a short time. That surprised us all.

Reading 11: Summary of Memory Block Pools

Allocating memory in a fast and deterministic manner is essential in real-lime applications. This is made possible by creating and managing multiple pools of fixed-size memory blocks called memory block pools.

Because memory block pools consist of fixed-size blocks, using them involves no fragmentation problems. This is crucial because fragmentation causes behavior that is inherently nondeterministic. In addition, allocating and freeing fixed-size blocks is fast— the time required is comparable to that of simple linked-list manipulation. Furthermore, the allocation service does not have to search through a list of blocks when it allocates and deallocates from a memory block pool—it always allocates and deallocates at the head of the available list. This provides the fastest possible linked list processing and might help keep the currently used memory block in cache.

Lack of flexibility is the main drawback of fixed-size memory pools. The block size of a

pool must be large enough to handle the worst-case memory requirements of its users. Making many different-sized memory requests from the same pool may cause memory waste. One possible solution is to create several different memory block pools that contain different sized memory blocks.

Each memory block pool is a public resource. ThreadX imposes no constraints to how pools may be used. Applications may create memory block pools either during initialization or during run-time from within application threads. There is no limit to the number of memory block pools that an application may use, too.

As noted earlier, memory block pools contain a number of fixed-size blocks. The block size, in bytes, is specified during the creation of the pool. Each memory block in the pool imposes a small amount of overhead—the size of a C pointer. In addition, ThreadX may pad the block size in order to keep the beginning of each memory block on proper alignment.

The number of memory blocks in a pool depends on the block size and the total number of bytes in the memory area supplied during creation. To calculate the capacity of a pool (number of blocks that will be available), we can divide the block size (including padding and the pointer overhead bytes) into the total number of bytes in the supplied memory area.

The memory area for the block pool is specified during creation, and it can be located anywhere in the target's address space. This is an important feature because of the considerable flexibility it gives the application. For example, suppose that a communication product has a high-speed memory area for I/O, you can easily manage this memory area by making it a memory block pool.

Application threads can suspend while waiting for a memory block from an empty pool. When a block is returned to the pool, ThreadX gives this block to the suspended thread and resumes the thread. If multiple threads are suspended on the same memory block pool, ThreadX resumes them in the order that they occur on the suspend thread list (usually FIFO).

However, an application can also cause the highest-priority thread to be resumed. To accomplish this, the application calls tx_block_pool_prioritize prior to the block release call that lifts thread suspension. The block pool prioritize service places the highest priority thread at the front of the suspension list, while leaving all other suspended threads in the same FIFO order[12].

Unit 12

Text 12: Little Endian and Big Endian Configuration

Little endian configuration: A byte load (LDRB) expects the data on data bus inputs 0~7 if the supplied address is on a word boundary, on data bus inputs 8~15 if it is a word address plus one byte, and so on. The selected byte is placed in the bottom 8 bits of the destination register, and the remaining bits of the register are filled with zeros, as shown in see Fig. 12.1.

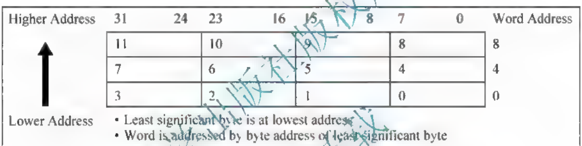


Fig. 12.1 Little Endian Addresses of Bytes within words

A byte store (STRB) repeats the bottom 8 bits of the source register four times across data bus outputs 0~31. The external memory system should activate the appropriate byte subsystem to store the data.

A word load (LDR) will normally use a word aligned address. However, an address offset from a word boundary will cause the data to be rotated into the register, so that the addressed byte occupies bits 0~7. This means that half-words accessed at offsets 0~2 from the word boundary will be correctly loaded into bits 0~15 of the register. Two shift operations are then required to clear or to sign extend the upper 16 bits. This is illustrated in Fig. 12.2.

A word store (STR) should generate a word aligned address. The word presented to the data bus is not affected if the address is not word aligned. That is to say, bit 31 of the register being stored always appears on data bus output 31.

Big endian configuration: A byte load (LDRB) expects the data on data bus inputs 24~31 if the supplied address is on a word boundary, on data bus inputs 16~23 if it is a word address plus one byte, and so on. The selected byte is placed in the bottom 8 bits of the destination register and the remaining bits of the register are filled with zeros, as is shown in Fig. 12.3. A byte store (STRB) repeats the bottom 8 bits of the source register four times across data bus

outputs 0~31. The external memory system should activate the appropriate byte subsystem to store the data.

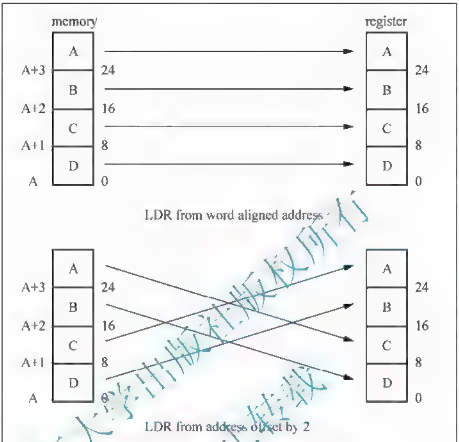


Fig. 12.2 Little Endian Offset Addressing

Higher Address	31 … 24	23 … 16	15 … 8	7 … 0	Word Address
↑	8	9	10	11	8
	4	5	6	7	4
Lower Address	0	1	2	3	0

• Most significant byte is at lowest address
• Word is addressed by byte address of most significant byte

Fig. 12.3 Big Endian Addresses of Bytes within Words

A word load (LDR) should generate a word aligned address. An address offset of 0 or 2 from a word boundary will cause the data to be rotated into the register, so that the addressed byte occupies bits 24~31. This means that half-words accessed at these offsets will be correctly loaded into bits 16~31 of the register. A shift operation is then required to move (and optionally sign extend) the data into the bottom 16 bits. An address offset of 1~3 from a word boundary will cause the data to be rotated into the register, so that the addressed byte occupies bits 8~15.

A word store (STR) should generate a word aligned address. The word presented to the data

bus is not affected if the address is not word aligned. That is to say, bit 31 of the register being stored always appears on data bus output 31[13].

Words and Expressions

1. boundary	['baundəri]	*n.*	①分界线 ②界线；范围
2. destination	[ˌdesti'neiʃən]	*n.*	①目的地；终点 ②目的；目标
3. remain	[ri'mein]	*v.&n.*	①剩余物；残余 ②遗迹；遗址；废墟 ③留下；逗留；剩下；余留
4. external	[eks'tə:nl]	*a.*	①外面的；外部的 ②外观的；表面的
5. memory	['meməri]	*n.*	①记忆力；记性 ②记忆中的事物；回忆 ③记忆系统；记忆容量
6. activate	['æktiveit]	*v.*	①使活动；启动；触发
7. appropriate	[ə'prəupriət]	*a.&v.*	①合适的；适合的；恰当的；相称的(for，to) ②(不适当地)擅用；挪用；盗用
8. rotate	[rəu'teit]	*v.*	①(使某物)旋转[转动] ②(使某人或某物)轮流[按顺序循环]
9. access	['ækses]	*n.& v.*	①入口；通道；使用途径；接近(或进入，使用)的门路(或方法) ②存取(计算机文件)；到达；进入；使用
10. extend	[iks'tend]	*v.*	①延长；扩展；达到(某一点) ②给予；提供；发出 ③持续存在；存在；实际上有
11. clear	[kliə]	*v.*	①变明朗；(天气)放晴；变清澈；变清楚 ②离去；溜走；消失 ③扫除；清除；(从计算机中)消除(数据) ④明确地；显然地；完全；一直
12. upper	['ʌpə]	*a.& n.*	①较高的；上部的 ②上面的；上层的(尤指同类或一对中的一个)
13. generate	['dʒenəreit]	*v.*	①产生；生成 ②引起；导致 ③生(儿、女)；再生；生殖；生育 ④[数学]动点成(线)；动线成(面)；动面成(体) ⑤[数学](给一组参数)作基数

14. optionally	[ˈɔpʃənəli]	*ad.*	①可选择地；选择性地 ②随意地；任选地
15. be filled with			充满着；装满
16. rather than			(要)……而不……；与其……倒不如……；
17. in the bottom of			在……底端；在……里的底下
18. be rotated into			旋转成
19. loaded into			加载到
20. be required to			要求；必须的
21. byte load(LDRB)			字节负载
22. data bus input			数据总线输入
23. word boundary			字边界
24. destination register			目标寄存器
25. source register			源寄存器
26. external memory			外存储器
27. data bus output			数据总线输出
28. address offset			地址偏移
29. shift operation			转移操作；转移运算
30. offset			抵消；偏移；偏置

Notes

(1) A byte load(LDRB) expects the data on data bus inputs 0~7 if the supplied address is on a word boundary, on data bus inputs 8~15 if it is a word address plus one byte, and so on.

本句为一个并列复合句。其中包括两个典型的条件状语从句。由连词 if 引导，表示在某种条件下很可能发生某事。

(2) An address offset of 0~2 from a word boundary will cause the data to be rotated into the register so that the addressed byte occupies bits 24~31.

本句为 so that 引导的结果状语从句。

Word-Study

I. Be filled with, Be surrounded with

(1) If a container **is filled with** something, it has had as much of something as possible put inside it.

(2) **Surrounded with** means to choose to have certain people or things near you all the time.

The reason why they can succeed is they were filled with enthusiasm.

All the audience is filled with amazement.

We are all filled with wonder why they didn't come to the meeting on time.

Surrounding himself with capable men, Romero worked hard to achieve his goals.

II. Load into/onto, Load down

(1) **Load into/onto** means to put a load of something on or into a vehicle.

(2) **Load** sb./sth. **down** means to make someone or something carry too many things or do too much work.

Coast Guard officials loaded the marijuana onto a plane.

Cora was loaded down with two 70-pound suitcases.

Sentence Patterns

I. Adverbial clause of condition

if, unless	(1) If it doesn't rain tomorrow, we will go hiking. (2) You will get good grades if you study hard. (3) I will go to the party unless he goes there too. (4) You will be late unless you leave immediately. (5) Let's go out for a walk unless you are too tired. (6) If you are not too tired, Let's go out for a walk. (7) If it rains tomorrow, we won't go on a picnic. (8) If I were you, I would go with him.
in case	(1) In case he comes, Let me know. (2) Take your umbrella in case it rains.
on condition that	I shall give you my dictionary on condition that you return it tomorrow.
providing provided (that)	I will go, providing/provided (that) my expenses are paid.
supposing suppose (that)	Suppose/Supposing (that) he does not come, what shall we do?
as long as (=so long as)	(1) I will cooperate as long as I am notified on time. (2) You may use the book so long as you will return it on time. (3) So long as you're happy, it doesn't matter what you do. (4) You may borrow my book as long as you keep it clean.

II. Adverbial clause of result

so	so + a./ad.	foolish nice a flower many / few flowers much / little money many people

such	such +n./n. phr.	a fool a nice flower nice flowers rapid progress a lot of people

The boy is/ He is
- so young that he can't go school.
- so handsome that all students like him.
- so clever that anything seems to be easy for him.
- such a young boy that he can't go to school.
- such a handsome boy that all students like him.
- such a clever that anything seems to be easy for him.

Exercises

Ⅰ.Answer the following questions with the information from the passage.

1. What is little endian configuration according to the text?
2. What is big endian configuration according to the text?
3. What are the similarities and differences between them?
4. Please analyze the Fig. 12.2 with your own words.
5. What will be generated for word store in little endian configuration?

Ⅱ. Choose an appropriate translation from Column B for each of the words in Column A.

		Column A		Column B
( )	1.	source register	A.	扩展；延伸
( )	2.	data bus input	B.	旋转
( )	3.	shift operation	C.	边界
( )	4.	extend	D.	数据总线输入
( )	5.	rotate	E.	适当的
( )	6.	boundary	F.	转移操作
( )	7.	appropriate	G.	源寄存器

Ⅲ. Complete these statements with the proper "content".

1. The selected byte is placed in the bottom 8 bits of the destination register, and the remaining bits of the register are filled with _______. (zeros, ones)

2. The external memory system should activate the _______ byte subsystem to store the data. (better, appropriate)

3. Two shift operations are then required to _______ or to sign extend the upper 16 bits. (clear, stop)

4. Bit 31 of the register being stored always appears on data bus _______ 31. (output, input)

5. The word presented to the data bus is not affected if the _______ is not word aligned. (word, address)

6. Pop music is such an important part of society _______ it has even influence our language. (that, which)

7. Take your umbrella _______ it rains. (in case, if)

8. You may use the book _______ you will return it on time. (on condition that, so long as)

Ⅳ. Change the two simple sentences into an adverbial clause.

1. You had come a few minutes earlier. You would have met him. (if)
2. He is sure to come. He has some urgent business. (unless)
3. He comes. Let me know. (in case)
4. I shall give you my dictionary. You return it tomorrow. (on condition that)
5. I will go. My expenses are paid. (providing/provided)
6. He does not come. What shall we do? (Suppose/Supposing (that))
7. I will cooperate. I am notified on time. (as long as)

Reading 12: Processes

All operating systems use one fundamental abstraction: the process. A process can be defined either as "an instance of a program in execution" or as the "execution context" of a running program. In traditional operating systems, a process executes a single sequence of instructions in an address space ; the address space is the set of memory addresses that the process is allowed to reference. Modern operating systems allow processes with multiple execution flows — multiple sequences of instructions executed in the same address space.

Multiuser systems must enforce an execution environment in which several processes can be active concurrently and contend for system resources, mainly the CPU. Systems that allow concurrent active processes are said to be multiprogramming or multiprocessing. It is important to distinguish programs from processes; several processes can execute the same program concurrently, while the same process can execute several programs sequentially.

On uniprocessor systems, just one process can hold the CPU, hence just one execution flow can progress at a time. In general, the number of CPUs is always restricted, and therefore only a few processes can progress at once. An operating system component called the scheduler chooses the process that can progress. Some operating systems allow only nonpreemptive processes, which means that the scheduler is invoked only when a process voluntarily relinquishes the CPU. But processes of a multiuser system must be preemptive ; the operating

system tracks how long each process holds the CPU and periodically activates the scheduler.

Unix is a multiprocessing operating system with preemptive processes. Even when no user logged in and no application is running, several system processes monitor the peripheral devices. In particular, several processes listen at the system terminals waiting for user logins. When a user inputs a login name, the listening process runs a program that validates the user password. If the user identity is acknowledged, the process creates another process that runs a shell into which commands are entered. When a graphical display is activated, one process runs the window manager, and each window on the display is usually run by a separate process. When a user creates a graphics shell, one process runs the graphics windows and a second process runs the shell into which the user can enter the commands. For each user command, the shell process creates another process that executes the corresponding program.

Unix-like operating systems adopt a process/kernel model. Each process has the illusion that it's the only process on the machine and it has exclusive access to the operating system services. Whenever a process makes a system call (i.e., a request to the kernel), the hardware changes the privilege mode from User Mode to Kernel Mode, and the process starts the execution of a kernel procedure with a strictly limited purpose. In this way, the operating system acts within the execution context of the process in order to satisfy its request. Whenever the request is fully satisfied, the kernel procedure forces the hardware to return to User Mode and the process continues its execution from the instruction following the system call[14].

附录 1

索　　引

		A	
access	['ækses]	*n.&v.*	①入门，通道，使用途径；接近(或进入，使用)的门路(或方法) ②读取(计算机文件)；到达；进入；使用
achieve	[ə'tʃi:v]	*v.*	①获得　②完成
activate	['æktiveit]	*v.*	使活动；启动；触发
address offset			地址偏移
Advent	['ædvənt]	*v.*	①出现，到来 ②将临期，基督降临(圣诞节前的 4 个星期)
algebra	['ældʒibrə]	*n.*	代数学，代数
alignment	[ə'lainmənt]	*n.*	结盟，队列，成直线
alter	['ɔ:ltə]	*n.*	改变；变更
alternative	[ɔ:l'tə:nətiv]	*n.*	二中择一，供替代的选择
		a.	供选择的，选择性的，交替的
analog	['ænəlɔ:g]	*n.*	模拟，模拟物
analog filter			模拟滤波器
analysis	[ə'næləsis]	*n.*	解析，分析
annular	['ænjulə]	*a.*	①环形，圆环　②有环纹(的)
antenna	[æn'tenə]	*n.*	①天线　②触角，触须
appropriate	[ə'prəupriət]	*a.*	适当的，恰当的，相称的
		v.	(不适当的)挪用，盗用
approximation	[əprɔksi'meiʃən]	*n.*	①接近　②近似额；概算　③[数]近似值
arc	[ɑ:k]	*n.*	①弧，弧线，弧形　②弧形物
		vi.	①作弧形运动　②形成电弧
array	[ə'rei]	*n.*	①数组，阵列　②展示，陈列 ③一系列；大堆，大量

as a consequence			因而，结果
attenuation	[ətenju'eiʃən]	*n.*	衰减
audio	['ɔ:diəu]	*n.&a.*	音频；音频的；听觉的，声音的
available	[ə'veiləbl]		①可用的 ②可获得的
axial	['æksiəl]	*a.*	轴的
		B	
be applied to			适用于
binary digits			二进制的数字
boundary	['baundəri]	*n.*	①分界线 ②界线；范围
bulb	[bʌlb]	*n.*	电灯泡
burn out			烧坏，耗尽，筋疲力尽
business process			商务处理
Butterworth			巴特沃斯
byte load(LDRB)			字节数据加载
		C	
cable	['keibl]	*n.*	①[电工学]电缆，多芯导线，被覆线 ②[航海学]锚索，锚链
capacitor	[kə'pæsitə]		电容，电容器
Cauer			考尔
characteristic	[kæriktə'ristik]	*n.*	特性，特征
Chebyshev			切比雪夫
circuit	['sə:kit]	*n.*	电路
circuitry	['sə:kitri]	*n.*	电路，线路
classification	[ˌklæsifi'keiʃən]	*n.*	①分类；分级 ②类别；种类；门类
classify	['klæsifai]	*vt.*	①分类；归类 ②划分；区分；界定
coaxial cable			同轴电缆
combine	[kəm'bain]	*vt.& vi.*	(使)联合，结合，组合，混合
complex	['kɔmpleks]	*a.*	复杂的，难懂的
component	[kəm'pəunənt]	*n.*	①成分，部件，元件 ②(混合物的)组成部分；成分；要素
composition	[ˌkɔmpə'ziʃən]	*n.*	①构图 ②构成，成分

comprise	[kəm'praiz]	*v.*	①包含，包括，由……组成 ②组成，构成
concentric	[kən'sentrik]	*a.*	同轴的，同心的
conductor	[kən'dʌktə]	*n.*	导体
conduit	['kɔndit]	*n.*	①[电]管道；水管，导电管 ②中转人；中转机构；中转国
confine	[kən'fain]	*v.*	①限制 ②禁闭
configuration	[kənˌfigju'reiʃən]	*n.*	组态；配置
configure	[kən'figə]	*v.*	配置，设定；使成形，使具一定形式
consist of			由……组成；由……构成
construct	[kən'strʌkt]	*v.& n.*	①修建；建立；建筑；建造 ②构成；组成 ③组成；创建；(按照数学规则)编制；绘制
consumption	[kən'sʌmpʃən]	*n.*	①消费；消耗；消费[耗]量 ②耗尽；用完
convert	[kən'vəːt]	*v.*	转变；转换
counterclockwise	[ˌkauntə'klɔkˌwaiz]	*a.*	逆时针方向的
current	['kʌrənt]	*n.*	①电流 ②水流，气流 ③流，流动
		a.	①现在的，现行的 ②通用的
cutaway	['kʌtwei]	*n.*	剖面图
cycle	['saikl]	*n.*	周期；循环
		D	
dash	[dæʃ]	*n.*	破折号
		vi.	猛冲
data bus input			数据总线输入
data bus output			数据总线输出
data movement			数据传送
declarative	[di'klærətiv]	*a.*	宣言的，公布的
depend upon/ on			依靠，信赖
depict	[di'pikt]	*v.*	①描绘；描画 ②描写；描述；刻画
deployment environment			部署环境

destination	[ˌdesti'neiʃən]	*n.*	①目的地；终点 ②目的；目标
destination register			目标寄存器
deteriorate	[di'tiriəreit]	*v.*	恶化，变坏，退化
deviation	[ˌdi:vi'eiʃən]	*n.*	尺寸偏差
device	[di'vais]	*n.*	①装置，设备，器具 ②手段，策略
diagram	['daiəgræm]	*n.*	图表，图解
digital systems			数字系统
dimension	[di'menʃən]	*n.*	(长、宽、厚、高等的)尺寸
discharge	[dis'tʃɑ:dʒ]	*n.*	①排放出的物体 ②获准离开，释放 ③卸船，(船的)卸货，(货物的)卸下
dish antenna			[计]碟形天线，抛物面天线
distinctive	[di'stiŋktiv]	*a.*	有特色的，与众不同的
distribution	[distri'bju:ʃən]	*n.*	分发，分配，配给物
dominant	['dɔminənt]	*a.*	①占优势的 ②统治的，支配的
dot	[dɔt]	*n.&v.*	①点，小圆点 ②布满；点缀
		vt.	①陪嫁 ②偿还
dual in-line package			双列直插式封装
		E	
electrical	[i'lektrikəl]	*a.*	①与电有关的 ②电学的，电的
electrical circuit			电路
electromagnetic	[i'lektrəumæg'netik]	*a.*	电磁的
encounter	[in'kauntə]	*vt.*	遇到，遭遇
equalization	[i:kwəlai'zeiʃən]	*n.*	均衡
external	[eks'tə:nl]	*a.*	①外面的；外部的 ②外观的；表面的
external memory			外存储器
employ	[im'plɔi]	*v.*	用，使用，采用
enterprise applications			企业应用程序
entirely	[en'taiəli]	*ad.*	全部地；完整地；完全地
execute	['eksikju:t]	*vt.*	①将……处死，处决，处以极刑 ②履行，执行，贯彻，实行，

extend	[iks'tend]	*v.*	①延长；扩展；达到(某一点) ②给予；提供；发出 ③持续存在；存在；实际上有
		F	
facilitate	[fə'siliteit]	*vt.*	促进，帮助，使容易
feed	[fi:d]	*vt.*	①加进(原料等)，供……以原料(或燃料) ②喂养，为……提供食物 ③向……提供
		vi.	吃，以……为食
		n.	①饲料(尤指粗饲料) ②喂送，进料；给水
fiber optics			光导纤维
fit	[fit]	*n.*	配合
fixed-function logic			固定功能逻辑
flow	[fləu]	*n.*	①流量 ②溜，流出
		v.	①流动 ②(血液)循环，流通
formulate	['fɔ:mjuleit]	*vt.*	①构想出，规划 ②确切地阐述
		G	
gain curve			增益曲线
generate	['dʒenəreit]	*v.*	①产生；生成 ②引起；导致 ③生(儿、女)；再生；生殖；生育 ④[数学]动点成(线)；动线成(面)；动面成(体) ⑤[数学](给一组参数)作基数
graphical	['græfikəl]	*a.*	图形的；图像的；图示的
ground return			地回路
		H	
highpass filter			高通滤波器
host computer			主机
		I	
identifier	[ai'dentifaiə]	*n.*	标识
implement	['implimənt]	*vt.*	①实现，完成，履行 ②填充，补充，弥补

in addition to			另外
in series			串联地；连续地
in that case			既然那样
incorporate	[in'kɔ:pəreit]	*v.*	①包含；加上；吸收 ②把……合并；使并入 ③组成公司 ④使具体化；体现；使混合
index	['indeks]	*n.& v.*	①标志；象征；量度 ②[数]指数；幂 ③指示；表示；迹象
indicate	['indikeit]	*n. & v.*	①标示；指示；指出 ②象征；表明或暗示……的可能性
inductor	[in'dʌktə]	*n.*	电感(器)
insert	[in'sə:t]	*n.& v.*	①插入；嵌入 ②(在文章中)添加；加插
insignificant	[insig'nifikənt]	*a.*	可忽略的，无关紧要的
insulate	['insjuleit]	*vt.*	隔离，使绝缘
insulating	['insjuleitiŋ]	*a.*	绝缘的
integral	['intigrəl]	*a.*	①构成整体所必需的；不可或缺的 ②完整的；完备的
integrated circuit			集成电路
interference	[intə'fiərəns]	*n.*	①干涉；干预；介入 ②阻碍(无线电信号的)干扰
interrogation zone			询问区
interrogator	[in'terəgeitə]	*n.*	①询问器 ②讯问者；审问者；质问者
Inverse Chebyshev			逆切比雪夫(逼近)
inverter	[in'və:tə]	*n.*	反用换流器；变极器；变频器
K			
Kinda cool			很酷，很有意思
L			
layer	['leiə]	*n.*	层，一层，阶层，层次
limit	['limit]	*n.*	极限
logic	['lɔdʒik]	*n.*	①逻辑(学) ②逻辑系统
logician	[ləu'dʒiʃən]	*n.*	逻辑学家
lowpass filter			低通滤波器

M			
magnitude	['mægnitju:d]	*n.*	①量，量值，强度，长度，大小，数量 ②重要性，重大 ③庞大，广大
mate	[meit]	*v.*	使配对，使一致
		n.	同伴，伙伴
mathematical	[mæθə'mætikl]	*a.*	①数学的，数学上的 ②精确的
mathematician	[mæθimə'tiʃən]	*n.*	数学家
measurement	['meʒəmənt]	*n.*	①尺寸 ②测量(法)
memory	['meməri]	*n.*	①记忆力；记性 ②记忆中的事物；回忆 ③记忆系统；记忆容量
minimize	['minəmaiz]	*vt.*	使减到最少，使缩到最小
monitor	['mɔnitə]	*v.*	监视，检测，监督，监控
		n.	①(学校的)班长，级长 ②监考员 ③监控器
monolithic	[ˌmɔnə'liθik]	*a.*	①整体的 ②庞大的
motor	['məutə, 'məutə(r)]	*vi.*	①开[乘]汽车 ②乘车旅行；驾车旅行
		a.	有引擎的，由发动机推动的
		vi.	①开[乘]汽车 ②乘车旅行
		n.	①马达，发动机 ②汽车
mount	[maunt]	*vt.*	登上，爬上，骑上，骑在……上
		n.	安装，固定
multiple	['mʌltipl]	*a.*	复合的
N			
native format			本机格式，原始格式
niche	[nitʃ]	*n.*	①合适的位置(工作等) ②(产品的)商机，市场定位 ③生态位(一个生物所占据的生境的最小单位)
O			
offset	['ɔfset]	*a.*	①补偿的 ②偏(离中)心的，偏置的 ③断错的 ④胶印的
optionally	['ɔpʃənəli]	*ad.*	①可选择地；选择性地 ②随意地；任选地

orientation	[ˌɔ:rien'teiʃən]	*n.*	方向，定向，向东方
oriented	['ɔ:rientid]	*a.*	①导向的；面向……的 ②以……为方向的；以……为目的的
owe… to			①把……归功于；应该感谢 ②欠……(某物)
		P	
parallel	['pærəlel]	*a.*	①平行的　②同样的，对应的
parameter	[pə'ræmitə]	*n.*	①(限定性的)因素，特性，界限 ②参量，参数
passband	['pɑ:sbænd]	*n.*	通频带
perform	[pə'fɔ:m]	*vt.*	履行，执行
		vi.	(机器)运转，(人)行动，表现
performance	[pə'fɔ:məns]	*n.*	①性能　②表现　③演出，表演 ④履行，执行
popularity	[pɔpju'læriti]	*n.*	普遍，流行
procedure	[prə'si:dʒə]	*n.*	程序，手续，步骤
programmable logic			可编程逻辑
proportional	[prə'pɔ:ʃənəl]	*a.*	①均衡的，相称的 ②比例的，成比例的
proposition	[prɔpə'ziʃən]	*n.*	①命题　②论点　③建议
protocol	['prəutəkɔl]	*n.*	①协议　②礼仪 ③(外交条约的)草案，草约
		R	
radiation	[reidi'eiʃən]	*n.*	辐射
reader	['ri:də]	*n.*	①阅读器　②读者
realm	[relm]	*n.*	区域，范围，领域
recognize	['rekəgnaiz]	*v.*	①认出；识别出某人[某事物] ②承认[认清](某事物)；认识到 ③察觉；意识到
refresh	[ri'freʃ]	*v.*	①刷新，更新　②使恢复；使振作 ③使……记起
reliability	[riˌlaiə'biləti]	*n.*	可靠；可信赖
remain	[ri'mein]	*v. & n.*	①剩余物；残余 ②遗迹；遗址；废墟 ③留下；逗留；剩下；余留

Repeaters	[ri'pi:təs]	*n.*	中继器
resist	[ri'zist]	*vt.*	抵抗，反抗，抗拒
		n.	①抗蚀护膜 ②阻膜，阻剂
resistor	[ri'zistə]	*n.*	电阻器
response	[ri'spɔns]	*n.*	① 回答；回音；答复 ②反应，响应
reverse	[ri'və:s]	*a.*	相反的，反向的
RFID Systems			射频识别系统
ripple	['ripl]	*n.*	波纹
rotate	[rəu'teit]	*v.*	①(使某物)旋转[转动] ②(使某人或某物)轮流[按顺序循环]
		S	
shift operation			移位运算
silicon	['silikən]	*n.*	硅，矽
software	['sɔftwεə]	*n.*	软件
source	[sɔ:s]	*n.*	①电源 ②源，源泉
source register			源寄存器
specific	[spi'sifik]	*a.*	特殊的，特定的
		n.	①特性 ②特效药
specified	['spesifaid]	*a.*	精确的；规定的
spur	[spə:]	*n.*	刺激，激励，鼓舞
		vt.	鞭策，鼓励
stopband	['stɔpbænd]	*n.*	阻带，抑止带
surface-mount technolo-gy			表面贴装技术
		T	
tag	[tæg]	*n.*	①标签，签条，标牌 ②名言，警句，引语，格言，谚语
telecommunication	[telikəmju:ni'keʃən]	*n.*	①远程通信 ②电信
terahertz	['terəhə:tz]	*n.*	太(拉)赫(频率单位，等于百亿赫)
terrestrial	[ti'restriəl]	*a.*	①陆地上的，地面上的 ②陆栖的；陆生的
through-hole type packages			通孔式封装
trade off			权衡，折中，取舍

traffic	['træfik]	*n.*	①通信量，(又称)业务量，话务量 ②流动的车辆[行人]，交通 ③(非法的)交易，买卖
transfer	[træns'fə:]	*v.*	① 转让；让渡 ②(使)调动；转职；转学；转车 ③转会(尤指职业足球队) ④转存，转录(资料、音乐等)；改编
transition	[træn'ziʃən]	*n.*	过渡，转变，转换
transfer	[træns'fə:]	*n.*	移动，转移，传递
		v.	①转移，移动　②传递
transmission	[træns'miʃən]	*n.*	①传送，传达　②传动装置，变速器 ③(电台或电视)信息，广播
transmit	[træns'mit]	*vt.*	传送，传达
trunk	[trʌŋk]	*n.*	①信息通路，总线，干线　②树干 ③衣箱　④象鼻
twisted pair			双绞线
		U	
upper	['ʌpə]	*a.& n.*	①较高的；上部的 ②上面的；上层的(尤指同类或一对中的一个)
user applications			用户应用程序
utilize	['ju:tilaiz]	*v.*	利用
		V	
variety	[və'raiəti]	*n.*	①品种，种类　②变化，多样化 ③(基于遗传差异的)变种
vicinity	[vi'siniti]	*n.*	①近，接近，密切　②附近，邻近
visible	['vizəbl]	*a.*	①看得见的，可见的，有形的 ②明显的，可察觉到的
voltage	['vəultidʒ]	*n.*	电压，伏特数，电位差
		W	
word boundary			词界
workstation	['wə:ksteiən]	*n.*	工作站，工作区

附录 2

参 考 答 案

Unit 1

Answers:

Ⅰ.

1. Radix 10 is important because we use it in everyday business and radix 2 is important because binary numbers can be processed directly by digital circuits.

2. The octal number system uses radix 8, while the hexadecimal number system uses radix 16.

3. The octal system needs 8 digits and the hexadecimal system needs 16 digits.

4. Each 3-bit string can be uniquely represented by one octal digit, and a 4-bit string can be represented by one hexadecimal digit.

5. Starting at the binary point and working left, we simply separate the bits into groups of three and replace each group with the corresponding octal digit.

6. If a binary number contains digits to the right of the binary point, we can convert them to octal or hexadecimal by starting at the binary point and working right.

7. We simply replace each octal or hexadecimal digit with the corresponding 3-bit or 4-bit string.

8. The octal number system was quite popular 25 years ago because of certain minicomputers that had their front-panel lights and switches arranged in groups of three.

9. In the hexadecimal system, two digits represent an 8-bit byte.

10. Many computer programming languages use the prefix "0x" to denote a hexadecimal number.

Ⅱ.

1. replaced … with…　2. consist of　3. be useful for　4. According to　5. Convert … to…

Ⅲ.

1. conveniently　2. requirement　3. process　4. extract　5. arranged　6. unique

Ⅳ.

1. G 2. E 3. B 4. D 5. A 6. C 7. H 8. F

Unit 2

Answers:

Ⅰ.

1. Floating-point notation can be used conveniently to represent both large as well as small fractional or mixed numbers.

2. Floating-point representation greatly increases the range of numbers, from the smallest to the largest, that can be represented using a given number of digits.

3. Decimal system: $N = m \times 10^e$, Hexadecimal system: $N = m \times 16^e$, Binary system: $N = m \times 2^e$.

4. Decimal numbers 0.0003754 will be represented in floating-point notation as 3.754×10^{-4} and a hexadecimal number 257.ABF will be represented as $2.57ABF \times 16^2$.

5. In the case of normalized binary numbers, the leading digit, which is the most significant bit, is always ‘1’.

6. Both the mantissa and the exponent can have a positive or a negative value.

7. The mixed binary number $(110.1011)_2$ will be represented in floating-point notation as $.1101011 \times 2^3 = .1101011e+0011$.

Ⅱ.

1. F 2. D 3. A 4. G 5. H 6. B 7. E 8. C

Ⅲ.

1. between… and… 2. is represented as 3. as well as 4. be said to 5. in the case of

Ⅳ.

1. equates 2. relative 3. imply 4. significance 5. respectively 6. normal

Unit 3

Answers:

Ⅰ.

1. When the diode is forward biased, it begins to conduct. 1V.

2. At turn-on, the diode can be considered an ideal switch because it turns on rapidly compared to the transients in the power circuit.

3. This reverse-recovery (negative) current is required to sweep out the excess carriers in the diode and allow it to block a negative polarity voltage.

4. Three and they are Schottky diodes, Fast-recovery diodes and Line-frequency diodes.

5. Referring to the text.

II.

1. D 2. E 3. C 4. B 5.G 6. M 7. K 8. A 9. O 10. I 11. J 12. N 13. F 14. H 15. L

III.

1. requirement
2. capability
3. inputted
4. analyzes
5. excess
6. compare

IV.

1. in combination with
2. swept out
3. was used for
4. depends on
5. make use of

Unit 4

Answers:

I.

1. 数字波形由在高低电压电平或高低电压状态之间来回变化的电压电平组成。

2. 在实际运用中，即使大部分数字脉冲可假定为理想脉冲，但这种情况也是不可能发生的。

3. 受寄生电感和电容的影响，会产生超调和振荡。

4. 从低电平到高电平所需的时间称之为上升时间，从高电平到低电平所需的时间称之为下降时间。

5. 波形特征 在数字系统里，人们所遇到的大多数波形都是由一系列的脉冲所组成的，有时，称之为脉冲序列，其他可分为周期性的和非周期性的。

Ⅱ.

1. K 2. F 3. N 4. C 5. B 6. H 7. I 8. G 9. A 10.L 11. O 12. D 13. J 14. E 15. M

Ⅲ.

1. resistance
2. randomly
3. generates
4. periodic
5. ratio
6. amplitude
7. assumed
8. pulse

Ⅳ.

1. because of
2. be classified as
3. consists of
4. is made up of
5. a series of

Unit 5

Answers:

Ⅰ.

1. Propositions can be classified as true or false.

2. In the 1850s, the Irish logician and mathematician George Boole developed a mathematical system for formulating logic statements with symbols.

3. Boolean algebra, as it is known today, is applied in the design and analysis of digital systems .

4. The lines connected to each symbol are the inputs and outputs.

5. The inputs are on the left of each symbol and the output is on the right.

6. The NOT operation is implemented by a logic circuit known as an inverter.

7. The OR operation produces a HIGH output when one or more inputs are HIGH.

Ⅱ.

1. burn out 2. depend on 3. be applied to 4. the same as 5. be classified as

Ⅲ.

1. apply 2. characterized 3. distinction 4. declared 5. logical 6. response

Ⅳ.

1. G 2. D 3. F 4. A 5. H 6. B 7. E 8. C

Unit 6

Answers:

Ⅰ.

1. Four and because of the nature of electrical circuits used to build analog filters.

2. In Fig. 6.2, a lowpass IIR filter is used to illustrate a Chebyshev approximation.

3. In Fig. 6.3, a bandpass IIR filter is used to illustrate a digital approximation to an analog Inverse Chebyshev bandpass filter.

4. Because the Cauer filter has narrower transition bands than any of the other three approximations.

5. Answers will vary.

Ⅱ.

1. D 2. B 3. F 4. E 5. C 6. B

Ⅲ.

1. ripples 2. transition 3. insignificant 4. approximation 5. deviation

Unit 7

Answers:

Ⅰ.

1. a ground return...a return wire

2. the channel

3. 4 kHz

4. coaxial cables...fiber optics

5. niche...analog audio communication

Ⅱ.

1. 仅增加带宽并不能满足不断扩展的通信量的需求。

2. 这个问题可以通过在特定的距离串联感应器(加感线圈)和各种大约 1MHz 均衡电路得到改善。

3. 地面以及卫星微波通信系统已进一步将带宽扩大到太(拉)赫的范围，对于那些能够负担得起抛物面天线和相关设备的人们来说，它能够把可以收看的电视频道增加到 800 多个。

4. 由于明线系统需要林立在城市街道的电线杆来延伸它那无休无止的电线，因此最终由双绞线电缆所取代。

5. 有限的带宽、相变以及信道噪声可引起信号退化，所以有必要沿信道的各个点进行信号的恢复或更新。

III.

1. dominant　2. refresh　3. electrical　4. deteriorated　5. radiations
6. visible　7. traffic　8. electromagnetic　9. concentric　10. analog

Unit 8

Answers:

I.

略

II.

1. F　2. A　3. E　4. B　5. C　6. D

III.

1. linear　2. similar　3. apply　4. virtually　5. notion
6. is similar to　7. applied to　8. connected with　9. in case

IV.

1. F　2. T　3. F　4. T　5. T　6. F　7. F　8. T

Unit 9

Answers:

I.

略

II.

1. G　2. D　3. A　4. E　5. F　6. B　7. C

III.

1. decreases　2. little　3. low-pass filter　4. more　5. would rather

IV.

1. F　2. T　3. F　4. T　5. T　6. T　7. T　8. F

Unit 10

Answers:

Ⅰ.

1. An RFID system comprises many other technologies, such as computer, network, Internet, wireless devices and software.

2. A typical RFID system is divided into two layers: the physical layer and Information Technology (IT) layer.

3. Referring the text.

4. Referring the text.

5. It is depicted at the bottom of the Fig.10.1.

6. The deployment environment consists of an interrogation zone (IZ) and objects in the vicinity of the IZ.

7. Because the performance of the RFID reader and tag is greatly affected by various characteristics of the deployment environment.

8. RFID software is divided into two groups: middleware and enterprise applications.

9. Answers will vary.

10. According to the requirements of the objects to be tagged, the distance at which the tags are to be read, the business processes during which tags are to be read, the speed of the tagged objects through the IZ and the number of tags in the IZ are to be.

Ⅱ.

1. E　2. C　3. H　4. J　5. A　6. O　7. B　8. G　9. I　10. D　11. F　12. N　13. L　14. M　15. K

III.

1. monitoring　2. performance　3. appropriate　4. comprises

5. components　6. depicted/depict　7. interference　8. protocol

Unit 11

Answers:

Ⅰ.

略

Ⅱ.

1. C　2. G　3. F　4. A　5. D　6. B　7. E

Ⅲ.

1. small, high, low　2. Points　3. IC　4. four　5. familiar with
6. familiar to　7. acquainted with　8. as well as

Ⅳ.

1. It is said that he has gone to Shanghai.
2. It happened that the two cheats were there.
3. What we need is time.
4. Who will be our monitor hasn't been decided yet.
5. That he finished writing the composition in such a short time surprised us all.

Unit 12

Answers:

Ⅰ.

略

Ⅱ.

1. G　2. D　3. F　4. A　5. B　6. C　7. E

Ⅲ.

1. zeros　2. appropriate　3. clear　4. output　5. address　6. that　7. in case　8. so long as

Ⅳ.

1. If you had come a few minutes earlier, you would have met him.
2. He is sure to come unless he has some urgent business.
3. In case he comes, let me know.
4. I shall give you my dictionary on condition that you return it tomorrow.
5. I will go, providing/provided (that) my expenses are paid.
6. Suppose/Supposing (that) he does not come, what shall we do?
7. I will cooperate as long as I am notified on time.

附录 3

参 考 译 文

第 1 单元

正文 1：八进制数和十六进制数

在日常生活中，普遍采用十进制数，而在数字电路中，普遍采用二进制数。其他数制在文件存储或其他应用中很广泛，如八进制数和十六进制数的使用，大大降低了的二进制数的位数，但人们通常并不直接使用。

八进制数权值为 8，而十六进制数权值为 16。表 1-1 显示了从 0 到 1111 的全部二进制数，及与每个二进制数相对应的八进制、十进制和十六进制数。八进制数需要 8 个数字，即十进制数中的 0～7。十六进制数需要 16 个数字，即十进制数中的 0～9 和字母 A～F。

八进制数、十六进制数的权值均是 2 的多次方，因此可有效地减少二进制数的位数。根据表 1-1 的第三栏和第四栏可知，3 位二进制数能够表示出 8 种不同的组合，每三位二进制数可以唯一的由一位八进制数来表示。同样，根据表 1-1 的第五栏和第六栏可知，4 位二进制数可以用一位十六进制数来表示。

表 1-1　二进制、十进制、八进制和十六进制数

Binary	Decimal	Octal	3-Bit String	Hexadecimal	4-Bit String
0	0	0	000	0	0000
1	1	1	001	1	0001
10	2	2	010	2	0010
11	3	3	011	3	0011
100	4	4	100	4	0100
101	5	5	101	5	0101
110	6	6	110	6	0110
111	7	7	111	7	0111
1000	8	10	—	8	1000
1001	9	11	—	9	1001
1010	10	12	—	A	1010
1011	11	13	—	B	1011
1100	12	14	—	C	1100

续表

Binary	Decimal	Octal	3-Bit String	Hexadecimal	4-Bit String
1101	13	15	—	D	1101
1110	14	16	—	E	1110
1111	15	17	—	F	1111

因此，二进制数到八进制数的转换并不复杂，从二进制数小数点左面的第一位开始，将二进制数每三位一组进行分组，并将每一组都用其相应的八进制数来表示。

$$100011001110_2=100\ 011\ 001\ 110_2=4316_8$$

$$11101101110101001_2=011\ 101\ 101\ 110\ 101\ 001_2=355651_8$$

同样，将二进制数转换成十六进制数时，只需每四位二进制数分成一组。

$$100011001110_2=1000\ 1100\ 1110_2=8CE_{16}$$

$$11101101110101001_2=01\ 1101\ 1011\ 1010\ 1001_2=1DBA9_{16}$$

在这些例子中，在最左边补 0 以达到总位数是 3 的倍数或 4 的倍数。

如果二进制数小数点右边有小数，要把它们转化成八进制或十六进制数，需从小数点右边的第一个数开始进行分组，最左边或最右边都可以补 0 以达到总位数 3 或 4 的倍数，如下例所示。

$$10.1011001011_2=010\ .\ 101\ 100\ 101\ 100_2=2.5454_8$$

$$=0010\ .\ 1011\ 0010\ 1100_2=2.B2C_{16}$$

将八进制或十六进制数转换成二进制数也很容易，仅需将八进制或十六进制数用与之相对应的 3 位或 4 位二进制数表示即可，如下例所示。

$$1357_8=001\ 011\ 101\ 111_2$$

$$2046.17_8=010\ 000\ 100\ 110.001\ 111_2$$

$$BEAD_{16}=1011\ 1110\ 1010\ 1101_2$$

$$9F.46C_{16}=1001\ 1111\ .0100\ 0110\ 1100_2$$

25 年前，某些小型机的面板灯及其开关是按 3 个一组进行排列的，因此普遍采用八进制数。但由于当今的机器多以字节(8 位二进制数)为单位，因此，在现代很少使用八进制数。用八进制数表示的数中，很难将个别的字节分离出来，例如，八进制数 12345670123_8 表示 32 位二进制数，应包含 4 个字节，那么每个字节的值分别用八进制数表示是多少呢?

在十六进制中，两个 16 进制数表示一个字节，则 2n 个 16 进制数代表包含 n 个字节的字，每两个 16 进制数总能精确的表达一个字节。例如，32 位的十六进制数 $5678ABCD_{16}$ 由 4 个字节 56_{16}、78_{16}、AB_{16} 和 CD_{16} 组成。用 4 位的二进制数可表示一位十六进制数，在这种情况下，常称其为半字节。一个 32 位(4 个字节)的二进制数有 8 个半字节。十六进制数通常用来描述计算机内存的地址空间。例如，16 位址计算机常被描述成在地址 0～$EFFF_{16}$ 有读写存储器，在 F000～$FFFF_{16}$ 处有只读存储器。许多计算机程序设计语言用前缀“0x”来表示一个十六进制数。例如，0xBFC0000[1]。

阅读课文 1：权数系统

通常，在学校学习和日常生活中所使用数字系统被称为权数系统。在权数系统中，数由一串数字来表示，权重与数字的位置有关。数值是数字的加权和，例如

$$1734=1\times1000+7\times100+3\times10+4\times1$$

权重是 10 的整数次幂，幂值取决于数字的位置。带小数点的 10 进制数，其权重有 10 的正整数次幂，同时也有 10 的负整数次幂，如

$$5185.68=5\times1000+1\times100+8\times10+5\times1+6\times0.1+8\times0.01$$

总之，形如 $d_1d_0.d_{-1}d_{-2}$ 的数 D，其值为

$$D=d_1\times10^1+d_0\times10^0+d_{-1}\times10^{-1}+d_{-2}\times10^{-2}$$

在上面的例子中，10 被称为基数或权值。在权数系统中，权值可以是任何大于等于 2 的整数 r，数字在位置 i，其权重为 r^i。权数系统的一般形式为

$$d_{p-1}d_{p-2}\ldots d_1d_0.d_{-1}d_{-2}\ldots d_{-n}$$

"."的左边有 p 个数字，"."的右边有 n 个数字，这个"."被称为小数点。如果没有小数点，认为该数为整数。数值等于各个数字与其权重相乘的总和，即

$$D=\sum_{i=-n}^{p-1} d_i \cdot r^i$$

若不考虑最高位和最低位的零，在权值系统中数的表示唯一。(而且，显然 0185.6300 等于 185.63。)其最左边的数字被称为最高位或最高有效位，最右边的是最低位或最低有效位。

数字电路的信号通常仅有两种状态：即不是高就是低、不是充电就是放电、不是关就是开。拥有两个值 0 和 1 的二进制数(或称二进位)适合表示这些信号的两种状态。因此，数字系统中通常使用二进制数。二进制数的一般形式为

$$b_{p-1}b_{p-2}\ldots b_1b_0.b_{-1}b_{-2}\ldots b_{-n}$$

其值为

$$B=\sum_{i=-n}^{p-1} b_i \cdot 2^i$$

在一个二进制数中，小数点被称为二进制小数点。对于二进制数或其他非十进制数，要是不知道权值，通常要用下标来表示其权值。下面是二进制数及其相应的十进制数。

$$10011_2=1\times16+0\times8+0\times4+1\times2+1\times1=19_{10}$$

$$100010_2=1\times32+0\times16+0\times8+0\times4+1\times2+0\times1=34_{10}$$

$$101.001_2=1\times4+0\times2+1\times1+0\times0.5+0\times0.25+1\times0.125=5.125_{10}$$

最左边的二进制数字被称为最高位或最高有效位(MSB)，最右边的是最低位或最低有效位(LSB)[1]。

第 2 单元

正文 2：浮点数

数值很大的数、较小的数及整数部分很大而小数部分又很小的数，都可以很方便地用浮点计数法来表示，同时，浮点表示法还可简化某些算术操作。浮点表示法大大增加了数的表示范围——从最小的数到最大的数，都可用指定位数的浮点数来表示。浮点数的一般形式为

$$N = m \times b^{e} \tag{2.1}$$

式中：m 是小数部分，称为有效位或尾数；e 是整数，称为指数；b 是计数系统或计数法的权值。小数部分 m 由 p 位数字形如(±d.dddd…)来表示，每一个数字 d 都属于 0 到 $b-1$ 之间，浮点数的标准化表示法规定 m 的首位数字不为零。

根据式(2.1)，十进制数、二进制数和十六进制数的浮点表示为

十进制

$$N = m \times 10^{e} \tag{2.2}$$

十六进制

$$N = m \times 16^{e} \tag{2.3}$$

二进制

$$N = m \times 2^{e} \tag{2.4}$$

例如，十进制数 0.0003754 和 3754 的浮点表示为 3.754×10^{-4} 和 3.754×10^{3}。十六进制数 257.ABF 的浮点表示为 $2.57ABF\times16^{2}$。对于二进制数，其标准化表示的首位即最高有效位总为 1，因此不需要存储。

而且，当用浮点数表示一个混合二进制数(既有整数又有小数部分)时，其小数点根据最高有效位即小数点右边的第一个数必须是 1 来进行移位。尾数和指数既可以是正数也可是负数。

混合二进制数$(110.1011)_2$的浮点表示为$.1101011\times2^{3}$=.1101011e+0011.。在这里，1101011 是尾数，e+0011 则表示指数为+3。再举一个例子，$(0.000111)_2$ 可写成.111e−0011，.111 作为尾数，e−0011 则表示指数为−3。同样，$(-0.00000101)_2$ 可写成$-.101\times2^{-5}$=−.101e−0101，−.101 作为尾数，e−0101 则表示指数为−5。如果想要用 8 位数字表示尾数，则.1101011 和.111 将表示成.11010110 和.11100000[2]。

阅读课文 2：ANSI/IEEE-754 格式

基于 Intel 芯片的个人计算机、苹果机及大部分采用 UNIX 操作系统平台的个人计算机普遍采用 IEEE-754 标准来表示实数，该标准包括 4 种格式，即单精度、双精度、单精度扩展和双精度扩展。表 2-1 列出了 IEEE-754 标准的 4 种格式的相应参数，在这 4 种格式中，最常用的是单精度和双精度，而单精度扩展和双精度扩展并不常用。

表 2-1　IEEE-754 标准的相应参数

Precision	Sign/bits	Exponent/bits	Mantissa/bits	Total length/bits	Decimal digits of precision
Single	1	8	23	32	>6
Single-extended	1	≥11	≥32	≥44	>9
Double	1	11	52	64	>15
Double-extended	1	≥15	≥64	≥80	>19

图 2.1 显示了单、双精度的基本内容，包括符号、指数和尾数，如图 2.1 所示，浮点数可用这些格式来表示。在符号位中，‘0’表示正数和‘1’表示负数。n 位指数不仅可表示正指数也可表示负指数，为了实现这一点，存储的指数等于实际指数加上偏移量 $2^{n-1}-1$，即 8 位指数的单精度格式需加上 127；11 位指数的双精度格式需加上 1023，这样，单精度 0~255 的指数范围为-127~128，双精度 0~2047 的指数范围为-1023~1024，即负的指数采用 2 的补码形式来表示。单精度格式数的范围为 2^{-127}~2^{+127}，相当于 10^{-38}~10^{+38}；当双精度格式时，范围为 2^{-1023}~2^{+1023}，相当于 10^{-308}~10^{+308}。

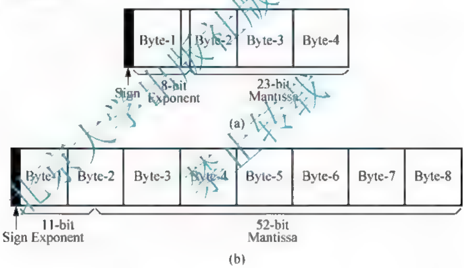


图 2.1　单精度和双精度格式

指数部分的极值用来表示特殊值。例如，对于单精度格式，当指数值为-127 时，是对指数 0 偏移的结果，即指数域实际为 0，在这种偏移后指数为 0 的情况下，如果尾数也是 0，那么，该浮点数的值为零；如果尾数不为零，由于其最高位不能为 1，因此不是标准化浮点数。偏移前为 255 的指数，实际上存储的是 128，由全 1 来表示，如果尾数是零，表示无穷大，尾数的符号位是用来区分是正无穷大还是负无穷大；如果尾数不为零，表示‘NaN’(非实数)。NaN 的值用来表示非实数。也就是说，8 位的指数可以表示-126~127 的指数值。图 2.1(a)表明，“Byte-1”的最高有效位指明了尾数的符号；“Byte-1”的其余 7 位和“Byte-2”的最高有效位表示 8 位的指数；“Byte-2”的其余 7 位和“Byte-3”、“Byte-4”的 16 位构成 23 位的尾数。尾数 *m* 需被标准化，标准化尾数的左手位总是“1”。虽然“1”并不存储，但实际上是默认为“1”的。同样，图 2.1(b)中列出了双精度格式。

根据单精度 IEEE-745 格式，下面分步将$(23)_{10}$转换成浮点数。

(1) $(23)_{10} = (10111)_2 = 1.0111\text{e} + 0100$。

(2) 尾数= 0111000 00000000 00000000。

(3) 指数= 00000100。

(4) 偏移后的指数= 00000100 + 01111111 = 10000011。

(5) 尾数的符号= 0。

(6) $(+23)_{10}$ = 01000001 10111000 00000000 00000000。

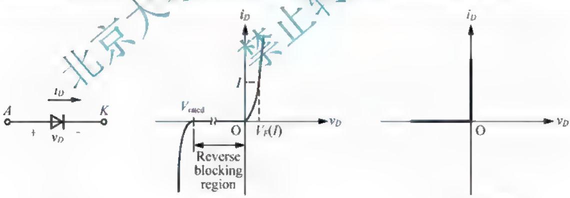
(7) 同样地，$(-23)_{10}$= 11000001 10111000 00000000 00000000[2]。

第 3 单元

正文 3：二极管

图 3.1(a)和图 3.1(b)显示了二极管的电气图形符号及其稳态伏安特性。当二极管正向偏置时，导通电压仅需近 1V 即可。当二极管反向偏置时，除非被反向击穿，其漏电流极其微弱。但在通常情况下，应避免反偏电压达到额定击穿电压。

鉴于二极管的截止(反偏)漏电流和正向导通电压与电路中的运行电压、电流相比可以忽略不计，因此就有了图 3.1(c)所示的理想二极管的伏安特性。理想伏安特性模型适用于分析电路结构，但不适合在实际设计中使用，尤其是当二极管的温度太高时。



(a) 符号　　(b) 伏安特性　　(c) 理想模型

图 3.1　二极管

与电源的瞬态效应相比，当二极管正向偏置时，导通非常迅速，可视为理想开关。然而，当截止时，如图 3.2 所示，二极管的反向电流需要经过一段反向恢复时间 t_{rr} 才能降为 0。反向恢复(负)电流是用来中和二极管中的过剩载流子，以便阻止负电压的产生。在电感电路中，反向恢复电流可导致过压。在大多数电路中，反向恢复电流不会影响输入与输出的相互转换，因此在截止时，二极管也可视为理想开关。

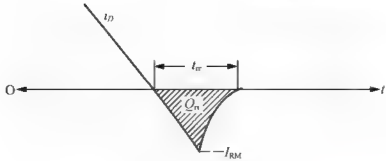


Fig.3.2 Diode turn-off

图 3.2 二极管的截止

二极管的种类繁多，可应用于各种需求。

(1) 肖特基二极管。肖特基二极管的正向压降通常是0.3V，可应用于输出电压很低的电路中。但其反向击穿电压也很低，处于50～100V范围内。

(2) 快速恢复二极管。快速恢复二极管的反向恢复时间很短，可应用于高频电路中的控制开关。对于几百伏特和上几百安培的电源，该二极管的恢复时间 t_{rr} 比几微妙还要短。

(3) 工频二极管。该二极管导通电压很低，结果 t_{rr} 很长，可应用于工频。且该二极管的截止电压达到了几千伏，导通电流也达到了几千安培。此外，根据电压电流的需要，还可将它们串联或并联[3]。

阅读课文 3：功率转换器

图 3.3 所示的电力电子系统框图中通常包括不止一个如图 3.4 所示的功率转换过程，通过电容器和电感器等储能元件，可分隔每个转换过程。因此，瞬时功率输入不等于瞬时功率输出。将每个功率转换过程都称为一个转换器。从而，转换器是电力电子系统最基本的模块(构件)。它由电子信号(集成电路中)可控制的功率半导体设备和类似于电感器和电容器那样能够储存能量的元件组成。根据转换器两边的交直流状态，其可分为以下几大类。

(1) 交流到直流。

(2) 直流到交流。

(3) 直流到直流。

(4) 交流到交流。

用功率转换器这个通用术语来代表具备上述任意一种功能的单一功率转换阶段。例如，在交流到直流和直流到交流的转换中，整流器指的是平均功率流从交流到直流的转换器；逆变器是指平均功率流从直流到交流的转换器。实际上，通过转换器的功率流有可能是双向的，在此情况下，如图 3.5 所示，转换器代表将整流器和逆变器作为一个双向模块。

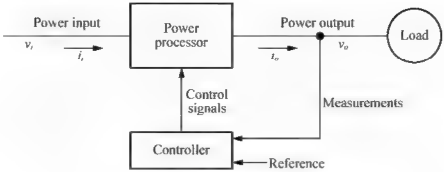


图 3.3　电力电子系统框图

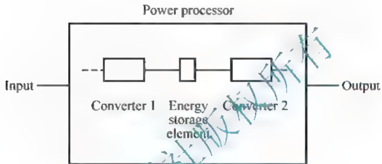


图 3.4　功率处理器结构图

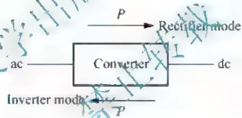


图 3.5　交流到直流转换器

举个例子，图 3.4 所示的功率处理器，代表可调速的交流驱动电机的模块结构。如图 3.6 所示，该模块包括两个转换器：转换器 1 是将工频交流转换成直流的整流器，转换器 2 是将直流转换成可调幅、调频的交流逆变器。在正常情况下，功率流从通用输入源到输出电机负载。在再生制动情况下，功率流反向(从电机到通用电源)，即转换器 2 作为整流器而转换器 1 作为逆变器。如前所述，在直流电路中，连接两个转换器的储能电容将两个转换器的瞬间转换工作分隔开来。根据转换器内部器件的转换方式，可将转换器分类，而这种分类方法可加深对转换器内部的理解。有如下 3 种可能的分类。

(1) 工频(自然换流器)转换器，转换器的一端为通用线电压，该电压应便于关闭功率半导体设备。同样，打开设备时，相位将线电压波形锁定。因此，设备的开启和关闭均在 50 或 60Hz 的工频频率。

(2) 开关(强制换流器)转换器，该转换器控制开关的频率比工频要高一些。但无论转换器内部开关的频率有多高，其输出或是直流，或与工频相近。此外，若输入为电压源，则输出为电流源，反之亦然。

(3) 谐振和准谐振变换器，在电压为零/或电流为零时即可打开/或关闭其可控开关[3]。

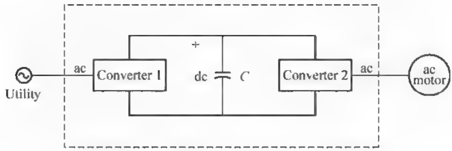


图 3.6　交流电机驱动工作图

第 4 单元

正文 4：数字波形

数字波形的电平由在高低电压电平或高低电压状态之间来回变化的电压电平组成。图 4.1(a)的正脉冲是指电压(或者电流)从低电平到高电平，再回到低电平。图 4.1(b) 的负脉冲是指电压从高电平到低电平，再回到高电平。数字波形就是由一系列的正负脉冲组成。

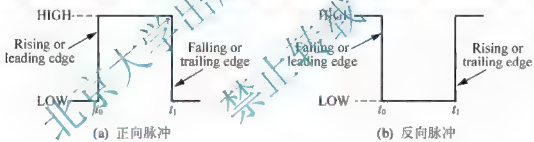


图 4.1　理想脉冲

脉冲：如图 4.1 所示，脉冲具有前沿和后沿：在 t_0 时刻首先出现前沿，在 t_1 时刻最后出现后沿。对于正脉冲，前沿是上升沿，后沿是下降沿。图 4.1 的所示的脉冲是理想脉冲，因为其上升沿或下降沿的转换是不需要花费时间的。在实际运用中，即使大部分数字脉冲可假定为理想脉冲，但真正理想的情况是不可能发生的。

图 4.2 是一般脉冲。实际上，所有的脉冲都具有部分或全部一般脉冲的特征。上升沿和下降沿有时会产生的超调和振荡是由分布电感和电容造成的。分布电容和电路电阻所形成的压降，能够产生较低时间常数的 RC 电路。

从低电平到高电平所需的时间称为上升时间(t_r)，从高电平到低电平所需的时间称为下降时间(t_f)。实际上，如图 4.2 所示，通常上升时间的测量方法是从脉冲幅度(从最低处到最高处的长度)的 10%到 90%所花费的时间，下降时间则是从脉冲幅度的 90%到 10%。考虑到波形中的非线性区域，上升时间和下降时间不包括脉冲顶部和底部的 10%。如图 4.2 所示，脉冲宽度是脉冲持续时间的测量，一般视为上升沿 50%和下降沿 50%之间的时间间隔。

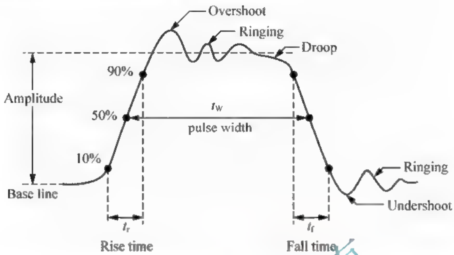


图 4.2　一般脉冲的特征

波形特征：数字系统里所遇到的大多数波形都是由一系列脉冲所组成，有时，称之为脉冲序列，其可分为周期性和非周期性。周期性波形以固定的时间间隔不断重复自身，这个时间间隔被称为周期(T)。频率(f)则是该波形重复自身的速率，单位是赫兹(Hz)。而非周期性脉冲的波形当然不会在固定的时间间隔里重复自身，如图 4.3 所示，其脉冲的宽度和时间间隔都很随机，并不一致。

图 4.3　数字波形

脉冲(数字)波形的频率(f)与其周期互为倒数。其关系为

$$f=\frac{1}{T} \tag{4.1}$$

$$T=\frac{1}{f} \tag{4.2}$$

周期性数字波形的一个重要特征是占空比，占空比是脉冲宽度(t_W)与周期(T)的比率[4]。可用百分数表示为

$$\text{占空比}=\left(\frac{t_W}{T}\right)100\% \tag{14.3}$$

阅读课文 4：传输二进制信息的数字波形

便于数字系统处理的二进制信息以波的形式描绘了比特序列。用二进制中的 1 代表波形的高电平；用 0 代表波形的低电平。序列中的每个比特所占的确定时间间隔称为比特时间。

数字系统的时钟：所有的波形都与一个被称为时钟的基本时间波形同步，时钟是周期性波形，它的周期为每两个脉冲之间的时间间隔，即比特时间。

对如图 4.4 所示的时钟波形，应注意波形 *A* 以时钟波形的上升沿触发。还有一种是下降沿触发。时钟每个一比特时间内，波形 *A* 或为高电平或为低电平。高低电平形成了如上所述的比特序列。一组比特序列可视为数字或字母等二进制信息。但时钟波形本身不含信息。

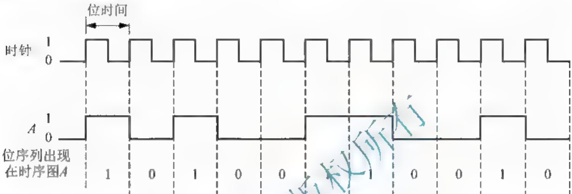


图 4.4　一个示例：时钟波形与比特序列相同步

时序图：数字波形的时序图表示两个或两个以上波形的实际时间关系及波形间的触发方式。通过观察时序图，可以确定在任意特定时间点上所有波形的状态(高或低)以及某个波形根据其他波形改变状态的确切时间。图 4.5 是由 4 个波形所组成的时序图，在这个时序图中，3 个波形 *A*、*B* 和 *C* 只在第 7 比特时间同时处于高电平状态，且在第 7 比特时间的末端，这几个波形又全部返回到低电平状态(阴影区域)。

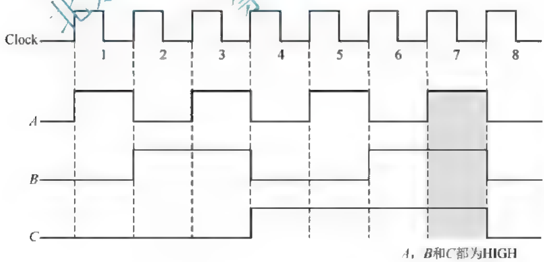
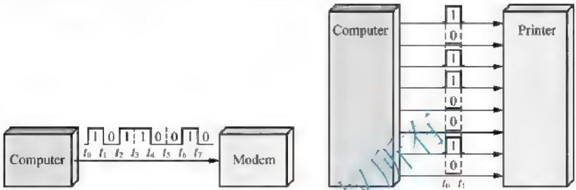


Fig. 4.5　Example of a timing diagram

图 4.5　时序图示例

数据传输：数据是指能传递某类信息的一组比特。由数字波形表示的二进制数据，若

在数字系统内，必能从一个电路传送到另一个电路，若为了实现某种特定目的，必能从一个系统传送到另一个系统。例如，为了实现加法运算，需要把以二进制形式存储在计算机内存中的数字传送到计算机的中央处理器单元，然后，将加法运算所产生的和或是传送到显示器以便显示，或返回到内存中。在计算机系统中，二进制数据的传输方式有两种：串口和并口如图 4.6 所示。



(a) 计算机到调制解调器串口传输8比特二进制数据，t_0到t_1为第一个时间间隔

(b) 计算机到打印机并口传输8比特二进制数据。t_0为开始时间

图 4.6　二进制数据串并口传输示例(仅显示数据线)

以串口方式将比特从一个点传送到另一个点时，每单位时间内沿着一条传输线传送一个比特，如图 4.6(a)所示，计算机到调制解调器的数据传输就采用串口方式。t_0 到 t_1 这段时间间隔里，传送第一个比特。t_1 到 t_2 这段时间间隔里，传送第二个比特，以此类推，传送 8 个比特需要 8 个时间间隔。

以并口方式传送比特时，同时通过单独传输线传送组内所有比特。如图 4.6(b)所示，计算机到打印机的数据传输就是以 8 比特并口方式，该例表明一条传输线对应一个比特。并口传送 8 比特只需要一个时间间隔，而串口需要 8 个时间间隔。

综上所述，二进制数据的串口传送的优点是需要的传输线很少，仅为一条。在并口传输中，传输线的数量与需同时一次完成传送的比特数量相等。串口传输的缺点是当传送同等长度的比特时，它比并口需要传输的时间长。例如，如果传输一个比特需要 1μs，那么串口传输 8 个比特需要 8μs，而并口传输只需 1μs。并口传输的缺点是需要的传输线比串口多[4]。

第 5 单元

正文 5：基本逻辑运算

逻辑基本隶属于推理范畴。若某特定条件为真，那么通过逻辑分析，某命题(声明状态)就为真。命题分为真命题和假命题。生活中遇到的许多静态状况和动态过程可以用具有逻辑功能的命题来表达。由于动态过程中的依赖关系不是真就是假，静态状况不是存在就是

不存在，因此具有两个状态的逻辑电路非常适合用来表示它们。

将几个命题结合起来，就会形成具有逻辑功能的命题。例如，有命题是这样陈述的：如果“电灯炮是好的”，同时“开关是打开”的话，那么“电灯就会亮”就是一个真命题。因此，其逻辑表述为：如果灯炮是好的并且开关打开的话，电灯才能亮。在这个例子中，如果后两种陈述是真的，那么第一个陈述也是真的。第一个陈述(“灯亮”)是基本命题，另两个陈述是基本命题所依赖的条件。

在19世纪50年代，爱尔兰逻辑学家、数学家乔治·布尔，为了能用近似于普通代数的方式来书写并解决逻辑问题，推出了能用符号将逻辑叙述公式化的一套数学系统，众所周知，当今布尔代数已应用于数字系统的设计和分析中。

逻辑这个术语被应用于执行逻辑功能的数字电路中。有几种数字逻辑电路是很基本的，像计算机那样复杂的数字系统就是由这几种基本逻辑电路搭建而成的。下面就看一下这几种逻辑电路，并大致探讨一下它们的功能，后续各章节将会详细对这些电路加以说明。

图5.1用标准的、特殊形状的符号来表示3种基本逻辑运算(非、与和或)。连接每一符号的直线代表输入和输出。每个符号左面的直线代表输入，右边的代表输出。执行特殊逻辑运算(与、或)的电路称为逻辑门。与门和或门的输入可以为任意个，图5.1中以破折号表示。

图 5.1 基本逻辑运算和符号

在逻辑运算中，前面提到的真/假条件现用高电平(真条件)和低电平(假条件)来表示。对于给定的一系列条件，每个基本逻辑运算(非，与和或)的输出都唯一。

非：如图5.2所示，非运算将逻辑电平从一个状态转换成与其相反的状态。当输入是高电平(1)时，输出就是低电平(0)；当输入是低电平时，输出就是高电平。无论哪种情况，输入与输出总不同。可执行非运算的逻辑电路被称为反相器。

图 5.2 非运算

与：与运算是指当所有的输入均为高电平时，其输出才是高电平。图5.3所示为具有两个输入的与运算。只有当一个输入是高电平，另一个输入也是高电平时，输出才是高电平。而当任何一个输入为低电平，或所有输入均为低电平时，输出为低电平。可执行与运算的逻辑电路被称为与门。

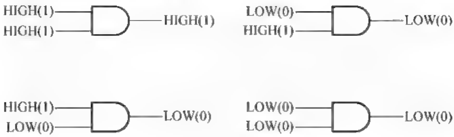


图 5.3　与运算

或：或运算是指当一个或多个输入为高电平时，输出为高电平。图 5.4 所示为具有两个输入的或运算。当一个输入是高电平，或者另一个输入是高电平，或者两个输入均为高电平时，其输出为高电平。当两个输入都是低电平时，其输出为低电平。可执行或运算的逻辑电路被称为或门[4]。

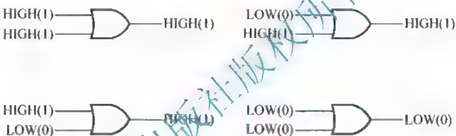


图 5.4　或运算

阅读课文 5：奈奎斯特准则：带宽与采样频率

典型线性调制系统是为了避免接收信号码间干扰而设计的，如图 5.5 所示的理想信道，信号需要通过发送端滤波器、信道(也视为滤波器)、接收端滤波器(可忽略接收端的噪声)，以 $1/T$ 的速率进入发送端滤波器，在没有信道失真和信道噪声的情况下，自然而然的推导出接收信号的采样频率和信号的发送频率相等，均为 $1/T$。为了避免码间干扰，当发送端滤波器、信道滤波器、接收端滤波器均满足奈奎斯特准则时，这种推导是正确的，这也正是下面要讨论的问题。

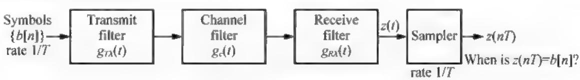


图 5.5　奈奎斯特准则应用框图

在图 5.5 中，接收端滤波器输出的无噪信号为

$$z(t)=\sum_{n} b[n]x(t-nT) \tag{5.1}$$

其中，

$$x(t)=(g_{TX}\cdot g_{C}\cdot g_{RX})(t) \tag{5.2}$$

该输出是整个系统对单一信号的响应。奈奎斯特准则所回答的问题是什么时候 $z(nT)=b[n]$? 也就是说，在信号等间隔采样时，怎样才能避免码间干扰？以下定理即为它的答案。

定理(避免码间干扰的奈奎斯特准则)当信号等间隔采样时，可以避免码间干扰，如

$$z(nT)=b[n] \qquad (\text{所有 } n) \tag{5.3}$$

若

$$x(mT)=\delta_{m0}=\begin{cases}1, m=0\\0, m\neq 0\end{cases} \tag{5.4}$$

用 $X(f)$ 表示 $x(t)$ 的傅氏变换，则之前的条件可写成

$$\frac{1}{T}\sum_{k=-\infty}^{\infty}X(f+\frac{k}{T})=1 \qquad (\text{所有 } f) \tag{5.5}$$

定理的证明：显然式(5.4)给出的时域条件码间干扰式(5.3)的可避免。由于 $B(f)$ 是 $x(t)$ 傅里叶变换 $X(f)$ 的移位 $X(f+k/T)$ 的和，因此可证明，$\{x(-mT)\}$ 是周期波形 $B(f)$ 的傅里叶级数，从而得出频域条件(5.5)和时域条件(5.4)等价。

$$B(f)=\frac{1}{T}\sum_{k=-\infty}^{\infty}x(f+\frac{k}{T}) \tag{5.6}$$

因此，若 $\{x(mT)\}$ 为离散冲激脉冲，周期函数 $B(f)$ 就为常量。

若 1/T 满足(5.4)或(5.5)，就称 1 / T 为脉冲 $x(t)$ 或 $X(f)$ 的奈奎斯特频率，在这里 $x(t)$ 或 $X(f)$ 是分散在数轴右边的任意常数。

最小带宽奈奎斯特脉冲：最小带宽奈奎斯特脉冲为

$$X(f)=\begin{cases}T, & |f|\leq\frac{1}{2T}\\0, & else\end{cases} \tag{5.7}$$

其对应的时域函数[5]为

$$x(t)=\operatorname{sin}c\left(\frac{t}{T}\right) \tag{5.8}$$

第 6 单元

正文 6：可近似模拟滤波器的 4 个基本函数的评介

虽然模拟滤波器的类型很多，但无论哪种类型最后都可归类为低通、高通、带通和带阻滤波器。然而，根据构建模拟滤波器的电路特性，又可将各类型的滤波器归为 4 个函数来近似模拟滤波器，这 4 个函数与理想滤波器相符合，其增益曲线或有波纹、或与光滑变化曲线有偏差。第一个近似模拟滤波器的函数称为巴特沃斯函数，其通带、阻带中没有波纹，因而其数字 IIR 滤波器中也不存在波纹。图 6.1 为理想低通滤波器巴特沃斯函数近似的大体增益曲线，理想高通、带通或带阻滤波器的近似图形与其相类似。在图 6.1 中，通带增益曲线变化光滑，且阻带达到采样频率的一半。

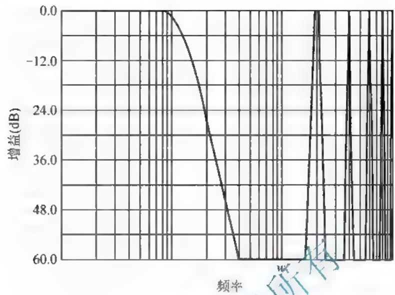


图 6.1　巴特沃斯低通 IIR 滤波器

第二个近似理想模拟滤波器的函数称为切比雪夫函数，其通带增益曲线存在波纹，而阻带光滑下降。图 6.2 所示为切比雪夫函数近似低通 IIR 滤波器，高通、带通或带阻滤波器的近似图形与其相类似。在图 6.2 中，由于增益曲线在下降之前的增加产生了通带的波纹。滤波器的阶数越高，纹波越明显，即其通带增益曲线有几周期的增加和减少。虽然这与理想滤波器产生了偏差，而这种偏差并不是人们所期望的，但切比雪夫滤波器的波纹使通带和阻带间的过渡带变窄，与巴特沃斯滤波器相比其过渡带更窄，更接近于理想滤波器。

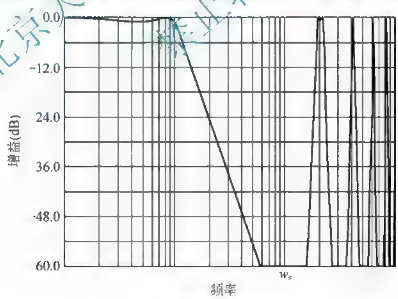


图 6.2　切比雪夫低通 IIR 滤波器

第三个近似理想模拟滤波器的函数称为逆切比雪夫函数，其通带没有波纹，但阻带有波纹。图 6.3 所示为逆切比雪夫函数近似带通 IIR 滤波器，同样，与理想滤波器的波纹偏差，并不是人们所期望的。但如同切比雪夫近似一样，其过渡带比巴特沃斯近似更窄。若

波纹的峰值处于理想阻带增益曲线之下，其阻带中波纹的多少并无大碍，正是这种波纹产生了与理想滤波器的偏差。逆切比雪夫函数同通带中有波纹的切比雪夫函数正相反。

第四个近似理想模拟滤波器的函数称为考尔函数，其通带和阻带都有波纹。这些波纹使考尔滤波器的过渡带比其他 3 种近似还窄。图 6.4 所示为考尔函数似带阻 IIR 滤波器。其阻带和通带都有波纹。如需设计高选滤波器，且允许其增益曲线有波纹，那么最好选择考尔滤波器[6]。

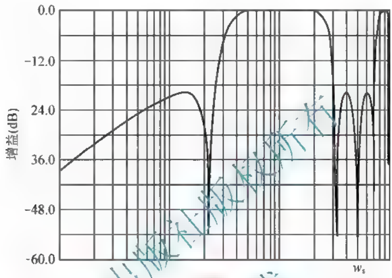


图 6.3　逆切比雪夫带通滤波器

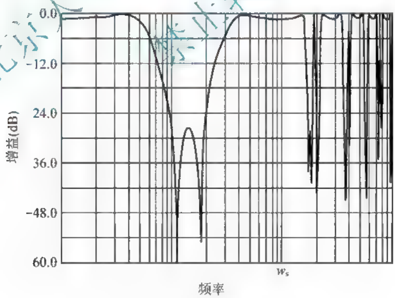


图 6.4　考尔函数似带阻 IIR 滤波器

阅读课文 6：内存字节资源概要

内存字节资源与标准 C 堆栈相似。与 C 堆栈不同的是，ThreadX 应用程序可以复用内存字节资源。此外，直至所需要内存可用之前，线程会中断内存字节资源的使用。

内存字节资源的调用类似于 malloc 函数调用，malloc 函数调用过程中包含一定量的期望内存(大量的字节)。ThreadX 以首次拟合的方式从内存字节资源中分配内存，即使用符合要求的第一个足够大的空闲内存块。ThreadX 将过量的分配内存从这一内存块转到新内存块中，也就是将其放回到空闲内存列表中，这一过程称为碎片存储。

当 ThreadX 执行接下来的内存分配，且该分配需要一足够大的空闲内存块时，则 ThreadX 将邻近的空闲内存块合并在一起，这一过程称为碎片整理。

每个内存字节资源都是公共资源，ThreadX 并不限制内存字节资源的使用方式。无论应用程序是在初始化期间，还是在运行期间，均可创建内存字节资源。应用程序使用内存字节资源的数量也没有明确的限制。

内存字节资源中可分配的字节数量比其创建期间所指明的数量略微少一些。这是因为空闲内存域的管理需要一定的内存开销。字节资源的每个内存块都需要与两个 C 指针等量的开销。此外，当创建内存资源时，ThreadX 自动将其分割成两个内存块，一个大空闲块和位于末端的小块。其中，末端小块施于永久分配，用来提升分配算法的性能，不必在合并期间持续检查资源的末端。在程序运行期间，资源开销数量通常是增加的，当部分需分配奇数个字节时，ThreadX 需填充此内存块以确保与下一内存块对齐边界。而且，随着碎片的增加，额外的开销也增加。

内存字节资源的内存域在创建期间就已被指明，像其他内存域一样，其可位于目标地址空间的任何位置。这一重要特性给应用程序带来相当大的灵活性。例如，如果目标硬件有一高速内存域和一低速内存域，通过在每个域内创建内存字节资源，使用者便可以来管理两个域的内存分配。

当等待资源中的内存字节时，可挂起应用线程。当邻近内存充足可用时，挂起线程获得所需内存并重新运行。若挂起了多个使用同一内存字节资源的线程时，ThreadX 按照各线程出现在“挂起线程列表”中的先后顺序来为其分配内存，并重新恢复其运行(通常为先入先出)。然而，在释放字节资源之前，若调用 tx_byte_pool_prioritize 命令来解除挂起线程，则可在挂起线程中优先恢复该应用程序。字节资源优先服务程序将高优先级别的线程置于挂起列表的前面，而其他挂起线程仍按照相同的先入先出顺序[7]。

第 7 单元

正文 7：带宽的发展与数字革命

电子远程通信是从以接地回路的单线传输发展起来的，但随着系统的发展，回流线取代了接地回路，随后，出现了明线电话线。由于明线系统需要林立在城市街道的电线杆来延伸它那无休无止的电线，因此最终由双绞线电缆所取代。双绞线电缆能够得以存在，需

归功于绝缘材料的改进，特别是塑料减少了电缆的占用空间。一对空载双绞线的带宽大约是 4kHz。由于双绞线长度越长，带宽下降越明显，因此应用各种各样的恒等式在特定的距离串联上感应器(加感线圈)使其带宽达到大约 1MHz，此外，在现代电话通信系统中，双绞线的带宽基本上可以满足模拟语音通信的需要。目前，电话通信的主要模式仍是直至话务中心，而各局间主干网络使用各种不同的信道来传输的信号远远超过了话务中心的业务量。

仅增加带宽不能满足日益增长的电信通信量。同轴电缆、地面微波网和光纤通信等新兴通信媒介的带宽很宽，为了充分开发利用其带宽，必须发展高频载波。由于同轴电缆使电磁波在两个同心导体的环形空间内传播，因此大大减少了辐射损耗，若不是同轴电缆的发展，辐射损耗一定相当大，结果同轴电缆使带宽增加了约 1GHz，而衰减却降低了。同卫星微波通信系统一样，地面通信也进一步将带宽扩大到兆赫级别，从而使那些能够买得起碟形天线和相关设备的人可以收看 800 多个电视频道。光纤通信的应用已将信道带宽拓展到可见光(1×10^{12}Hz)，目前，一条光纤的信道容量可达到 300×10^{9} 条电话信道之多。

数字技术的广泛应用渐渐成为电子通信中的主导因素。数字技术是指将信息压缩成一串脉冲序列(二进制数字，1 和 0)，并在信道中发送。而由于带宽的限制、相位的变化以及信道噪声引起了信号的退化，所以必须沿信道的不同点安装中继器来“刷新”或重新生成信号，中继器的功能是判断所发送的数字是 1 还是 0，根据判断结果，再将新生成的数字传送出去。在接收端，将数字再转换回模拟信号，该项技术常应用于压缩音乐光盘刻录系统中。计算机间信息传输的需要加速了数字通信的发展，在电话通信中，语音信号也正逐步转成数字形式。

阅读课文 7：图像传输

电报出现后不久，Giovanni (1815—1891 年)在法国试着通过电子手段来进行图像传输。他把图像分成小块，并将每小块的编码信号通过电话线来发送，然后在接收端重组图像。即使是传输静态图像，该系统也是非常缓慢的，但它建立了图像传输的基本原则，即将图像分解成某基本元素(扫描)、将每个基本元素根据亮度进行量化(编码)，发射端与接收端之间需要某种同步，从此以后，无论是用机械还是电子来进行实际图像传输，都需具备这些基本过程。

Joseph May 是爱尔兰的一名电话接线员，爱尔兰位于横跨大西洋电缆的一端，Joseph May 在 1873 年发现，当硒电阻暴露在阳光下时，其电阻值会下降。由此发明了光电传感器。随后，在这一发现的基础上，George Carey, William Ayrton (1847—1908 年)，John Perry 以及其他一些人设计出多种图像传输方案，但由于缺乏足够的扫描系统，也由于必须用单独的电路来发送图像中每一基本元素，使得这些方案不切合实际，从而无一成功。

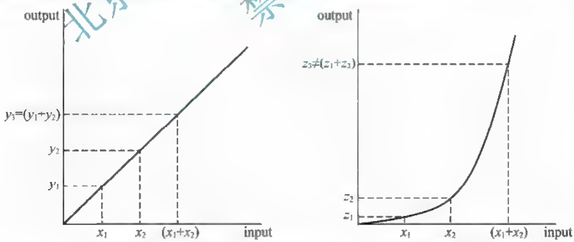
1884 年，德国将名为尼普科夫圆盘的专利授予保罗尼普科夫(1860—1940 年)，尼普科夫圆盘上的孔洞呈螺旋形式排列。当通过第二张圆盘观测图像时，第二张圆盘与第一张圆盘孔洞相似，且与第一张圆盘做同步运动，观测到的效果相当于点点构成线，线线构成整个图像。由于在一系列单电路中可以发送或接收图像的点点灰度值，因此这一方案切实可行，同时依赖人眼对图像的停留性来建立一个完整的图像，实际上，完整的图像信息是逐

点显现的。尼普科夫方案直到 1927 年才得以实施，那时候，早被发明的感光细胞、光电倍增管、电子管放大器和阴极射线管已足够成熟，信号处理速度能够满足电视播放的需要，在这其中，有些人对于某个元件，甚至是整个电视系统的发展做出了重大贡献，查尔斯·詹金斯(1867—1934 年)和约翰·贝尔德(1888—1946 年)这两个人几乎同时成功实现了图像传输。他们都使用了尼普科夫圆盘。直到 1930 年左右，各种各样的机械扫描方法仍能得到成功的应用，大约在 1930 年弗拉基米尔·兹沃尔金(1889—1982 年)发明了“映像管”，菲洛·法恩斯沃思(1906—1971 年)发明了被他称为“图像分解器”的“电子摄像管”。这些发明最终以电子扫描替代了所有电视扫描系统中的机械移动组件。超高频载波和同轴电缆的应用大大提高了图像的画质。早在 20 世纪 30 年代，就已证明彩色电视机的可行性，但直到 20 世纪 60 年代中期，人们才看上了彩色电视。到了 20 世纪 80 年代，卫星通信系统为那些能够买得起碟形天线的观众提供了大量的电视节目。到 21 世纪初，碟形天线的尺寸已从 3m 多缩小到不足 70cm，信号也变成了数字信号[8]。

第 8 单元

正文 8：叠加原理

在电子电气工程中，叠加原理非常简单，但却非常重要。其原理图如图 8.1 所示。定理的一般定义如下：“若初始状态为静态，且输入信号为两个或更多的线性系统，其总输出是每个单独输入(其他输入置 0)产生输出的叠加之和”。换句话说，如果一个线性系统的输入为 x_1，其相应输出为 y_1；另一个输入 x_2，相应输出为 y_2，那么若输入为 x_1+x_2，其相应的输出为 y_1+y_2。在以下讨论的电路中，x 和 y 为电压或电流。



(a) 线性电路中的叠加原理　　(b) 非线性电路中的迭加原理

图 8.1　叠加原理

原理的证明并不复杂，在图 8.1(a)中，由 x_1-y_1，x_2-y_2 和 $x_1+x_2-(y_1+y_2)$ 组成 3 个三角形，且几何上相似。因此有

$$\frac{y_1}{x_1}=\frac{y_2}{x_2}=\frac{y_1+y_2}{x_1+x_2} \tag{8.1}$$

在图 8.1(b)所示的非线性电路中，x_1-z_1 等三角形不相似，因此迭加原理并不适用于非线性电路。

叠加原理的重要性主要因为以下几个方面。

(1) 它仅允许同一量纲的测量和计算。其结果在任何其他量纲中，可同比例放大或缩小，以求得所需量值。

(2) 在任意时间段内，对于输入信号较多的电路，通过它可以简化测量和计算输出结果。且在同一时间内，全部信号输出与期间每个输入信号所产生的输出之和相等。

(3) 若某类波形作为输入，通过测量和计算得出的结果，为其他波形作为输入电路的输出提供信息。例如，由傅里叶变换对应关系，测量和计算正弦波得出的结果可以用来计算方波所产生的输出结果。傅里叶变换建立了时、频两域以及时域波形和其频谱之间的联系。几乎在所有电子领域中，使用这种最便捷的方式来描述电路特性是极其有用的。

针对电路分析，该原理的另一种定义如下："在仅包含几个独立电压源或电流源的线性电路中，经由电路元件两端的电压及电流是每个激励单独作用该元件所产生的电压或电流的代数和。"

注意：因为 $P=I^2R=V^2/R$，所以功率与电压或电流并不是线性关系，因此叠加原理并不能直接用于计算功率[9]。

阅读课文 8：线性系统

在如图 8.2(a)所示的线性电路中，输出和输入之比是定值。换言之，即输出幅值与输入幅值成比例。因此，举例来说，若输入扩大一倍，则输出也扩大一倍。图 8.2 (a) 和 8.2 (c) 的传递函数曲线通过原点，因此输入为 0 时，输出为 0。图 8.2 (b)所示的传递函数曲线则不同，当输入为 0 时，输出并不为 0。在截距不为 0 的线性系统中，输入变化与输出变化(增量的比值)是定值，而不是它们的幅值之比为定值。与非线性电路相比，线性电路更易于理解和分析。

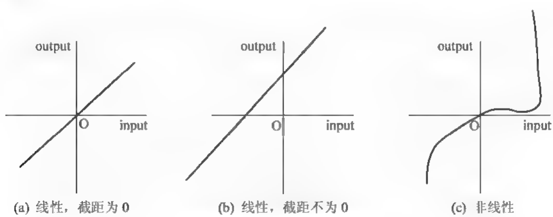


图 8.2　输入输出的 3 种关系

对于电路分析，在多数情况下，一般认为电路中的无源元件、电阻、电感和电容都是线性的，除非有明确说明它们是非线性的。在电路和设备的实际测试中，情况也如此。但显然要考虑来自于组件功耗和它们本身的绝缘率等限制。举一个线性的例子，例如，作用于电阻两端的电压和与之产生的流过该电阻电流的比值是定值，则这个定值被称为电阻。

一般认为，无论电阻两端施加的电压是大是小，其阻值不变。如果认为阻值是变化的，那么计算就相当复杂。当然，实际中，随着电压的增加，电阻会变热，增大了功耗，根据电阻制作材料不同，其阻值变化也不同。然而在大多数(但并非所有)情况下，这种变化可以忽略不计。而在有些阻性设备中，电阻变化很大。例如，热敏电阻的变化使其阻值成为温度的函数，因此，可以用其来测量温度。

电感的线性取决于其核心的磁材料。气芯电感的线性好，而铁芯(铁氧体心)电感一般线性不好。当使用后者时，必须注意设备的线性特性是否适于测量及计算。

将电容视为线性元件，一般仅限在特定应用范围内。

一般认为，在所有应用范围内，半导体设备都是非线性的。而且，线性模型的使用常稍稍超出其应当的应用范围[9]。

第 9 单元

正文 9：低通滤波器

图 9.1 所示电路与我们最初用于理解电容效应时所使用的 RC 电路很相似。不同的是现在的输入信号为交流信号，而不是之前的阶跃信号。

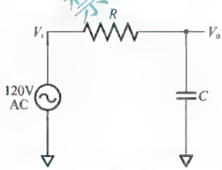


图 9.1　基于电容的低通滤波器

该电路称为低通滤波器，若理解其工作原理，首先要明白分压理论及频率怎样影响电容。若将其视为简单的分压电路，则根据电阻的比值就可以计算出输出电压。电容也像电阻一样，但其阻抗取决于频率，那么当频率从 0 变化到无穷大时，电容的阻抗将发生怎样的变化呢？

电容阻止低频电流通过，而交流信号可以通过。电容电流随着信号频率的增大而增大，最终短接输出电阻和地，因此输出分压也越来越小。当频率值为 1/RC 时，输出电压为输入电压的一半。第一眼看到 1/RC，就注意到它正是时间常数的倒数。它在这里出现，是不

是很有意思?

之所以称其为低通滤波器，是因为它通低频，而阻高频。用一个电感和一个电阻也可以制作成低通滤波器。因电感与电容作用相反，是否能想象出这个电路是什么样？请看图 9.2。

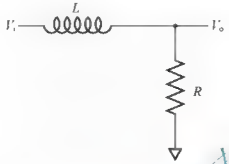


图 9.2　基于电感的低通滤波器

在这里，需要调换元件的位置。这是因为电感(与电容相反)通低频而阻高频。尽管形式上稍有不同，但该电路与 RC 低通滤波器的功能相同。仍将它想象成为分压电路，但接地电阻部分电路并不产生变化，取而代之的是输入电阻产生变化。当低频时，电感短路，电流可顺利通过接地电阻。随着频率增强，电感将电流阻断，这种方式就像是分压器的输入元件具有更大阻抗。反之，当频率降低时，接地电阻在分压电路中所占的比值越来越大。

总之，低通滤波电路中，随着频率由低到高，电容开始由开路变为短路，而电感开始由短路变为开路。通过调换分压电路中元件的位置，也可达到相同的滤波效果。两种形式的滤波电路中，从分压电路中分得的电压比随频率增加而降低。这样，通低频而阻高频。现在，如果再调换元件在这些电路中的位置，又会怎样呢[10]?

阅读课文 9：有源滤波器

到目前为止，已研究了无源滤波器。无源元件不能对外供电。因为是无源的，因此这些元件容易受负载的影响。这意味着，接到输出端的任何电路都可以影响滤波器的性能。以低通 RC 滤波器为例，如图 9.3 所示，把一个电阻接到输出端。

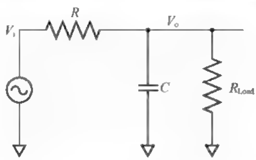


图 9.3　滤波器加负载

输出端的这个电阻是负载。负载可能不在输出端，而在电路中的其他部分，或者不是

电阻，而是其他任何元件，但重要的一点是它的作用是接地电阻。它对 RC 滤波器的性能有怎样的影响呢？为便于理解，利用戴维南等效电路，来观察负载怎样影响输出。首先，无论是交流电压源还是直流电压源，都要将其短路并接地，因此，该电路就可以看成如图 9.4 所示的电路。

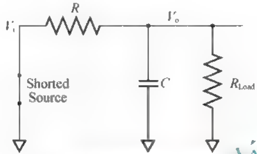


图 9.4　戴维南等效电路展示负载效应

令 R = 10k，R_{Load}=10,000，C =0.1μf。当用戴维南定理等效电路时，在可能合并的地方，尽可能将所有元件合并成一个。由于两个电阻并联，根据电阻并联规则，求得 5kΩ的电阻值。由于电路接上了负载，R 值的变化很大。你是否已注意到了？乍一看可能违反直觉的事实是，该电路的时间常数是根据刚获得的戴维南等效电路而变化的量，即若没有负载，则 τ 为 10000×0.1μs，即等于 1ms。

若加上负载，则 τ 的值是 0.5ms，是原来的一半。由于滤波器的输出取决于 τ，因此可看到负载具有的影响很大。避免这个问题的一种方法是在设计中增加一个有源元件，将它制作成一个“有源”滤波器。加入这样元件的基本思想是将负载效应减少到预期的响应值。无论负载是什么，有源滤波器的输出不会影响滤波器的响应值，如图 9.5 所示。

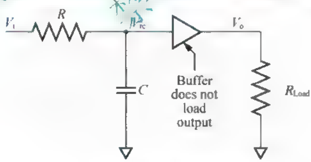


图 9.5　有源缓冲器消除负载效应

有源元件的输入端(称为运算放大器)具有很高的阻抗，相当于 10M 电阻，只要它远大于电路中 R 的值，则当将其连接在 RC 滤波器上时，电路中的时间常数应没什么变化。电路中缓冲区输出的电压与输入电压相匹配。它将信号缓冲，并且，无论输出端连接什么，滤波器将不会受到影响。这是最简单的有源滤波器之一，但有源滤波的原理是相同的，即包含一个有源元件来保护或提高滤波器的性能[10]。

第 10 单元

正文 10：射频识别系统

RFID 设备可仅由一标签和一读卡器组成，但 RFID 系统则涵盖许多科学技术，如计算机、网络、互联网、无线设备以及软件，这些技术与 RFID 设备一起构造了一套完整的系统。典型的 RFID 系统可分为两个层次：物理层和信息技术(IT)层。

物理层包括以下几方面内容。

(1) 一个或多个射频标签。

(2) 一个或多个应答器(读卡器)。

(3) 一个或多个读卡器天线。

(4) 环境构建。

IT 层包括以下几方面内容。

(1) 与读卡器相连接(直接或通过网络)的一个或多个主机。

(2) 适当的软件(设备驱动程序、滤波器设计程序、中心层、数据库和用户应用程序)。

图 10.1 为 RFID 系统的鸟瞰图，它由标签、读卡器、网络、带有应用软件的计算机，以及监视器前所有操控人员。由图 10.1 底部可看出 RFID 系统中各部分数据的传输模式为双向传输模式。在商业应用 RFID 过程中，可以从标签中读取数据，也可将数据写入标签。例如，当货物通过码头时，可从货物标签中读取数据，当生产制造货物时，可将货物从一个工作站到另一个工作站的信息写到标签上。

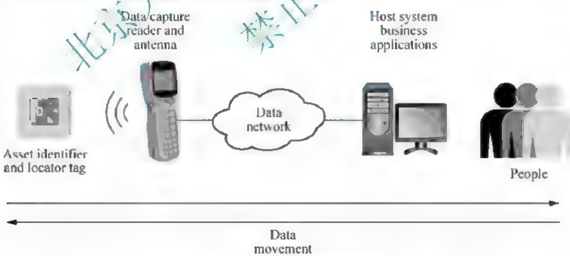


图 10.1 射频识别系统鸟瞰图

图 10.2 为 RFID 系统的物理层，它由标签、天线、读卡器及环境部署组成。环境部署包括一个应答区(当标签经过该区域时，能接收到读卡器发射的无线电波)和应答区周边的识别目标。由于环境部署的各种特性对 RFID 的读卡器和标签的性能具有较大的影响，因此将环境部署纳入物理层中。部署空间的射频干扰、部署空间识别目标的类型、大小、形状都影响着标签的读取性能。

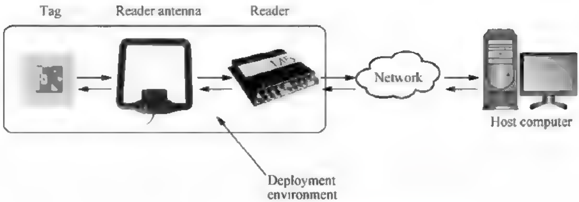


图 10.2　射频识别系统的物理层

所有的 RFID 系统都有 IT 层。IT 层包括各种计算机系统，网络，数据库和应用软件。RFID 软件分为两类：中心层与企业应用软件。中心层直接与 RFID 的物理层交换信息，从而能从读卡器收集数据，将商务处理信息加入到数据、储存数据，并为企业应用软件提供数据，其数据的格式为中心层本地格式。中心层也能管理、监控，并配置硬件系统，其建立了从商业管理的企业应用软件到硬件系统的通道。企业应用软件，也称为商务应用软件，用于商业管理的数据是利用中心层从读卡器获得的数据。如在码头，开发票及向顾客发放账单的数据就来源于 RFID 读卡器接收到的数据。

RFID 标签、读卡器、天线的种类繁多，任由挑选购买。RFID 系统的设计人员根据标记目标的需求、标签与读卡器的距离、读取标签时的处理内容、通过读卡器时标签的移动速度及同时通过读卡器时标签的数量来选择合适的标签、读卡器和天线。由于 RDID 标签的大小、形状、工作频率、应用协议、动力来源、写入次数各不相同，因此各地价格也从十几美分到几美元不等。因为 RFID 读卡器的工作频率、应用协议、功率级别千差万别。所以，RFID 天线的大小、形状、频率和阵列模式也不尽相同[11]。

阅读课文 10：自动识别技术

自动识别技术是指自动收集与目标相关的数据、自动将该数据存入数据库，且任何自动收集、自动存储的过程均不需人工介入的技术。自动识别技术无处不在，它默默地、高效地处理着成千上万件乏味的工作。自动识别技术的最大工作自然是回答一些信息交流方面的问题，如“它是什么？”、“它在哪里？”、“它怎么样？”——最初，自动识别技术能够识别与跟踪的主要对象为人们能说出来名字的盒子、人、动物等。与人相比，自动识别与跟踪技术快速、准确、低成本。自动识别的方法很多，如磁墨水字符识别(MICR)、磁条、语音识别、生物测量和条形码等，而 RFID 仅是其中之一。

磁墨水字符识别可识别油印字，支票底部的签名通常为油印字，当支票通过 MICR 识别器时，必须迅速、准确判断签名者是否为其本人。当信用卡和借记卡上的磁条接触到识别器时，如同支票底部油印字签名的识别一样需准确判断持卡者身份。条形码由一系列不同宽度的黑白条纹组成。条形码有数百种之多，但零售行业普遍使用最常用的通用产品代

码(UPC)。条形码需要一束光线和与条形码相关的扫描仪来准确识别。配销中心(DCs)拣货时常使用语音识别，由于语音识别既不需要用手去拿着，也不需要用眼睛去盯着，更不需要将标签对准识别器，因此其比条形码识别好得多。识别人身份的指纹识别和视网膜扫描识别均为生物识别技术。许多最新的计算机用指纹识别来鉴别用户身份。若进入高警戒地区，则需通过视网膜扫描识别。视网膜扫描识别也可用来鉴别牲畜。

那么，既然有这么多的自动识别技术，为什么像 RFID 这样的技术会突然脱颖而出而变得如此受欢迎呢？所有原因都归结于一点，即无线电波。RFID 技术涉及应用电磁波(无线电波)、部分电磁光谱来识别单项商品、身份、动物或人类。RFID 的用途很多，通常使用识别码(就是一种名字)，该识别码存储在与天线相连接的集成电路(IC)中，能唯一地标识需要识别的商品、身份、动物和人，集成电路和天线统称为 RFID 发射器或标签。标签要与需识别的商品、身份、动物和人相连。称与标签进行通信并从标签读取识别码的设备为问询器或读卡器，读卡器将识别码输入到信息系统中，信息系统将识别码储存在数据库中，或者从数据库中找出该识别码，然后将商品、身份、动物和人的信息返回。自动识别技术种类繁多，其主要区别为存储和读取识别码的方式不同[1]。

第 11 单元

正文 11：固定功能集成电路

前面所有已讨论过的具有某逻辑功能的逻辑元件，一般来说都采用集成电路的形式。由于体积小，可靠性高，成本低、功耗低等特点，集成电路多年来一直应用于数字系统中。因此，了解集成电路的封装、管脚的电气连接、管脚的编号，熟悉决定各种集成电路分类的复杂拓扑结构及电路设计技巧是很重要的。

单片机的全部电路都搭建于一个体积很小的单硅芯片上。该电路的所有构件——三极管、二极管、电阻、电容，都整合成单一晶片。数字集成电路的两大分类为固定功能逻辑和可编程逻辑。固定功能逻辑的逻辑功能是由制造商设置的，不能更改。

图 11.1 为一固定功能集成电路封装的剖面图，从图 11.1 中可看到封装内的电路芯片。芯片上各点连接到封装管脚，并通过这些管脚与外界进行输入或输出。

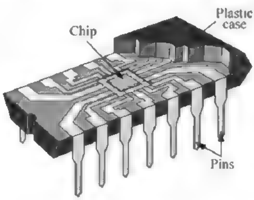
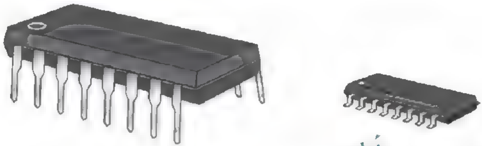


图 11.1 带有内部芯片与外部输入输出管脚连接的固定功能集成电路封装剖面图

集成电路封装：根据集成电路在印制电路板上的安装方式，集成电路(IC)封装可分为插针式封装和表面贴片式封装。插针式封装将管脚插入到印制电路板的过孔中，因此可与电路板的另一面导体相焊接。图 11.2(a)所示的是最常见的插针式封装：双列直插式封装(DIP)。



(a) Dual in-line package (DIP)　　(b) Small-outline IC (SOIC)

图 11.2　插针式封装和表面贴片式封装器件实例。双列直插式封装比具有相同管脚数量的小外形集成电路的尺寸大。双列直插式封装大约 0.785 英寸长，而小外形集成电路约 0.385 英寸长。

另一种集成电路封装使用表面贴片技术(SMT)。表面贴片式封装比插针式封装节省空间，且不需要穿过印刷电路板的过孔。其直接将表面贴片封装的管脚焊接在电路板一面的导体上，电路板的另一面可焊接其他电路。此外，由于管脚排列得更紧密，若管脚数量相同，表面贴片式封装的尺寸要远远小于双列直插式封装。图 11.2(b)为小外形集成电路(SOIC)的表面贴片式封装。

表面贴片封装的 3 种常见类型为 SOIC(小外形集成电路)、PLCC(塑料有管脚芯片载体)和 LCCC(陶瓷无管脚芯片载体)。根据电路要求管脚数量的多少(管脚数量越多，电路越复杂)，采用不同尺寸的不同类型封装。图 11.3 展示了 3 种类型的封装。实际的封装形状如图 11.3 所示，小外形集成电路(SOIC)的管脚呈“翼”形。塑料有管脚芯片载体(PLCC)的 J 型管脚弯曲到封装的底部。没有管脚的陶瓷无管脚芯片载体(LCCC)的瓷体本身有金属触点。其他类型的表面贴片封装有 SSOP(缩短小外形封装)、TSSOP(缩短细小外形封装)与 TVSOP(薄小外形封装)。

管脚编号：所有 IC(集成电路)封装的管脚编号都有一个标准格式。图 11.4(a)为 16 管脚的双列直插式封装(DIP)和小外形集成电路封装(SOIC)的管脚编号方式。从封装顶部看，管脚 1 的标识符可能是一个小圆点，凹口或者一个斜边。小圆点始终紧挨着管脚 1，同时凹口表明管脚编号的方向，如管脚 1 始终为左上角的管脚。由管脚 1 开始，向下编号，当编号到最下面管脚时，从对面向上编号。最大的管脚编号总是在凹口的右侧或者小圆点对面。

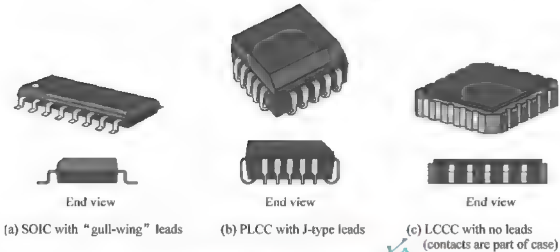


图 11.3 表面贴片式封装的例子

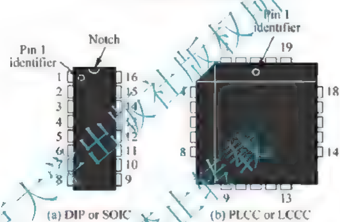


图 11.4 集成电路封装的两种标准格式的管脚编号(顶视图)

塑料有管脚芯片载体(PLCC)和陶瓷无管脚芯片载体(LCCC)封装的 4 个边均有管脚。用小圆点或其他符号标识位于某组管脚中心位置的管脚 1。从封装顶端看，管脚逆时针编号。最大的管脚号总是在管脚 1 的右侧。图 11.4(b)为 20 管脚的塑料有管脚芯片载体(PLCC)的管脚编号方式[4]。

阅读课文 11：内存块资源概述

在实时应用中，通过创建和管理大量内存块资源(固定大小的内存块)来实现的快速、准确的内存配置是十分关键的。

内存块资源由固定大小的内存块组成，它的重要性还体现在使用内存块资源可避免内存碎片的产生，而由内存碎片引起的问题很多，很难确定。另外，分配、释放固定大小的内存块比简单链表所需的操作时间都要快。此外，当从内存块资源分配及释放内存时，因为分配和释放的内存总是位于有效块列表的表头，所以不必搜索块列表。这些优点使最快速的链表处理成为可能，并且，还有助于将目前使用的内存块保存到高速缓冲中。

对于大小固定的内存池，其主要弊端是灵活性不够。池块的尺寸必须大到能够处理用

户最大的内存需求。对于大量不同大小的内存需求，若用相同大小的资源块，则可导致内存浪费。一种可行的解决方案是创建几个包含大小不同内存块资源。

每个内存块资源都是公共资源。ThreadX 操作系统并没有严格限制资源的使用方法。无论是初始化的状态，还是程序运行期间，应用软件都可以创建内存块资源。每个应用程序使用内存块资源的数量也没有限制。

如前所述，内存块资源包含一组固定大小的资源块。块大小的单位为字节，在资源创建时，要明确规定块的大小为多少字节。资源中的每个内存块都要有少量的超调量——指针 C 的大小。此外，ThreadX 操作系统可对块大小打上补丁，以便在适当调整时，不断地对内存块进行初始化。

资源中的内存块的数量取决于块的大小及其创建时存储区所能提供的内存字节总数。在该存储区内，若要计算资源容量(可用块数)，则需将块的大小(包括打补丁和指针的超调所需字节)分割成字节总数。

在创建内存块资源时，应明确规定块资源的内存范围，并可寻址目标地址空间的任意地址。这一特点的重要性在于：为应用程序提供了相当大的灵活性。例如，假设某通信产品的 I/O 有高速内存区，那么可通过创建内存块资源来轻松地管理这块内存区域。

在等待空资源中的的内存块时，可以挂起应用程序的线程。而当释放某内存块回到资源中时，ThreadX 操作系统将为该内存块提供给已挂起的应用程序的线程，然后恢复该线程。在同一内存块资源中，若挂起多个线程，ThreadX 操作系统会按照它们出现在挂起线程列表中的顺序依次恢复它们(通常为先入先出)。

但是，应用程序也可使最高优先线程得以优先恢复。要做到这一点，应用程序将调用 tx_byte_pool_prioritize 命令优先将内存块释放给该挂起线程。块资源优先服务程序将最高优先线程置于挂起线程列表中的顶端，与此同时，其他的挂起线程仍保持原有的先入先出顺序[12]。

第 12 单元

正文 12：小端存储格式与大端存储格式

小端存储格式： 若将存储器中地址恰好在某字边界的某字节数据加载到目的寄存器中(字节数据加载命令为 LDRB)，加载的数据从数据总线的 0～7 位输入，若地址为某字的边界再加上一个字节时，加载的数据从数据总线的 8～15 位输入，依此类推。加载的字节存放到目标寄存器的低 8 位，目标寄存器的其余位用零填充，如图 12.1 所示。

Higher Address	31　　24	23　　16	15　　8	7　　0	Word Address
↑	11	10	9	8	8
	7	6	5	4	4
	3	2	1	0	0
Lower Address					

• Least significant byte is at lowest address
• Word is addressed by byte address of least significant byte

图 12.1　字中的小端字节地址

字节数据存储(字节数据存储命令为 STRB)是指将源寄存器中的低 8 位字节数据重复 4 次，经数据输出总线的 0～31 位存储到存储器中。若存储数据到外部存储器中，则需选择相应的字节子系统。

字数据加载(字数据加载命令为 LDR)通常为字对齐地址。若将地址偏移字边界的数据加载到寄存器，首先应进行数据的循环移位，以便使与字边界对齐地址的字节数据占寄存器的 0～7 位。这意味着加载半字偏移数据即偏移字边界两个地址的数据时，该数据位于字边界 0～2 个字节的数据直接加载到寄存器的 0～15 位。然后，需要进行两个地址的循环移位运算，对寄存器的高 16 位清零或符号扩展，如图 12.2 所示。

字数据存储(字数据存储的命令为 STR)产生字对齐地址。数据总线上需存储的数据不会受到地址是否字对齐的影响。也就是说，寄存器上第 31 位数据总是存储到数据输出总线的第 31 位上。

大端配置：若将存储器中地址恰好在某字边界的某字节数据加载到目的寄存器中(字节数据加载命令为 LDRB)，加载的数据从数据总线的 24～31 位输入，若地址为某字的边界再加上一个字节时，加载的数据从数据总线的 16～23 位输入。以此类推，加载的字节存放到目标寄存器的低 8 位，目标寄存器的其余位用零填充，如图 12.3 所示。字节数据存储(字节数据存储命令为 STRB)是指将源寄存器中的低 8 位字节数据重复 4 次，经数据输出总线的 0～31 位存储到存储器中。若存储数据到外部存储器中，则需选择相应的字节子系统。

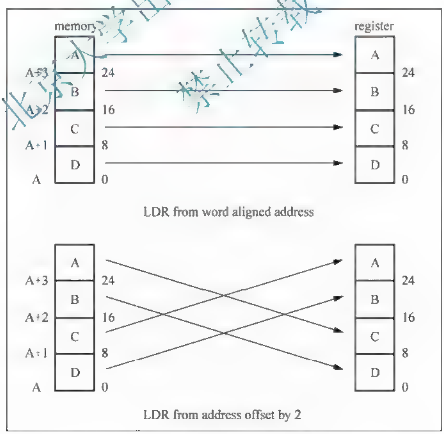


图 12.2　小端地址偏移

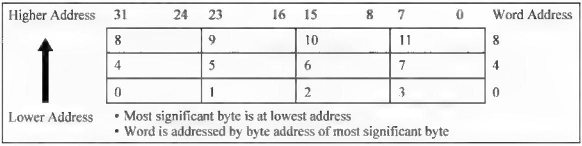


图 12.3 字中的大端字节地址

字数据加载(字数据加载命令为 LDR)通常为字对齐地址。若将偏移字边界 0 个地址或两个地址的数据加载到寄存器，首先应进行数据的循环移位，以便使与字边界对齐地址的字节数据占寄存器的 24～31 位。这意味着当加载半字偏移数据即偏移字边界两个地址的数据时，该数据位于字边界处的两个字节数据将直接加载到寄存器的 16～31 位。然后，需要进行两个地址的移位运算，对寄存器的高 16 位清零或符号扩展(可选)，若将偏移字边界一个地址或 3 个地址的数据加载到寄存器，首先应进行数据的循环移位，以便使与字边界对齐地址的字节数据占寄存器的 8～15 位，如图 12.2 所示。

字数据存储(字数据存储的命令为 STR)must字对齐地址。数据总线上需存储的数据不会受到地址是否字对齐的影响。也就是说，寄存器上第 31 位数据总是存储到数据输出总线的第 31 位上。

阅读课文 12：进程

所有操作系统最基本、最抽象的概念之一是进程。进程的定义为“执行程序的实体”，或定义为正在运行程序的“执行环境”。在某地址空间中，传统操作系统的进程执行单指令队列，地址空间指的是进程可以调用的内存地址集合。现代操作系统的进程允许多执行流，即同一地址空间执行多指令队列。

多用户系统所必需的执行环境应允许同时激活多进程来抢占系统资源，系统的主要资源是 CPU 资源。允许同时激活多进程的系统称为多道程序系统或多进程系统。能将程序和进程区分开是非常重要的，这样几个进程可同时执行相同的程序，而同一进程可顺序执行多个程序。

在单处理器系统中，一进程独占一 CPU 资源，即一个 CPU 每次执行一个执行流。一般来说，由于 CPU 数量有限，因此同时执行的进程也有限。由称为进程调度的操作系统组件来选择处理哪个进程。某些操作系统仅允许非抢占进程，意味着当且仅当进程自愿放弃 CPU 资源时，才能激活进程调度。但多用户系统的进程一定是抢占式进程；操作系统追踪每个进程占据 CPU 资源时间的长短，并定期激活进程调度。

Unix 为抢占式进程调度的多进程操作系统。甚至在没有用户登录、没有应用程序正在运行的情况下，系统的许多进程也在同时监控着外围设备。特别是，还有许多进程同时监听等待用户登录的系统终端。当用户输入登录名，监听进程就运行验证用户密码的程序。如果用户身份验证成功，则进程创建另一个新进程来运行能够输入命令的 Unix 命令行。

当激活图形显示时，进程就运行窗口管理器，每个显示窗口通常是由单一进程来运行。当用户创建图形命令行时，一个进程运行图形窗口管理器，另一个进程运行能够由用户输入命令的图形命令行。对于用户的每个命令，命令行进程都会创建另一个进程来执行相应的命令程序。

Unix 的类似操作系统采用进程/内核模式。每个进程都使人觉得它是机器上唯一的进程，觉得它独占操作系统的内外资源。无论何时，当进程运行系统调用时(如请求内核)，硬件便进行模式转换，如从用户模式转为内核模式，进程也开始执行目标明确的内核程序。这样，操作系统为满足进程的要求，转换进程执行所需环境。每当完成请求，内核程序将迫使硬件返回用户模式，进程也继续执行接下来系统调用的指令[14]。

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